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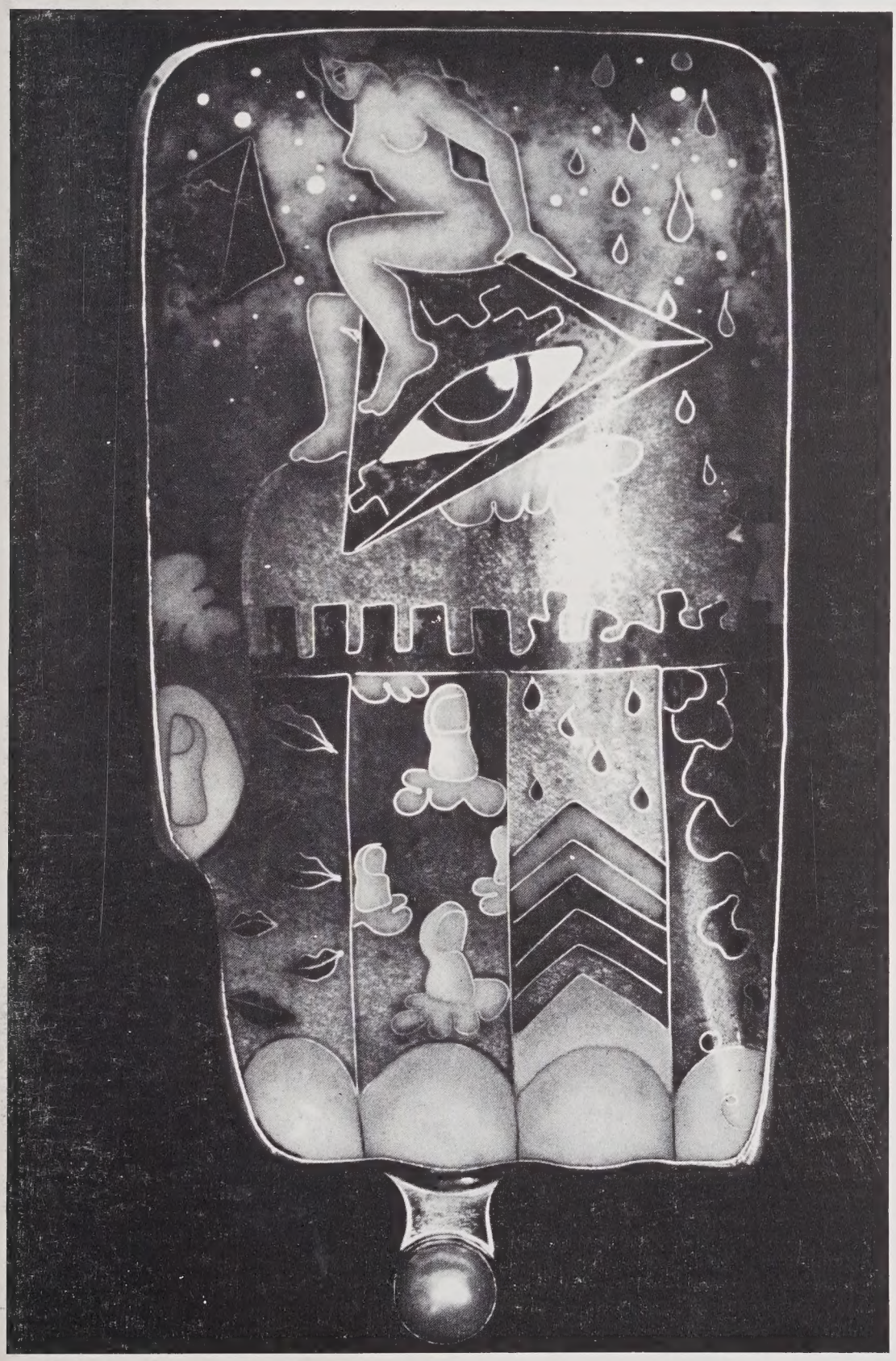
GOLDSMITHS

# GOLDSMITHS JOURNAL



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June 1979

*Colette, "Symbiosis I," Pendant, fine silver, enamel, 24k and pearl*

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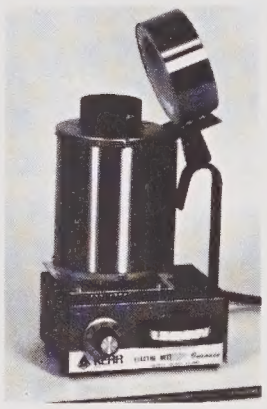

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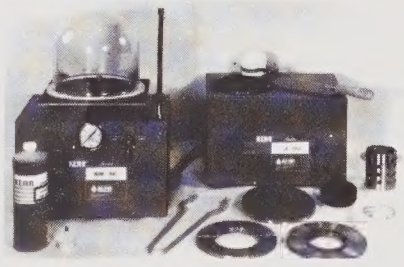

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## REVIEWS

### EXHIBITION REVIEWS

**COLETTE'S CLOISONNE JEWELRY AT MOBILIA GALLERY, Cambridge Massachusetts, March 1979**

by Anne Erickson

Colette's cloisonne jewelry sings in brilliant color and symbols the lyrics of personal liberation. She fuses designs of bold turquoise, purple, green, orange and yellow enamels onto fine silver and gold bracelets, pendants and rings. Each layer of color is fired separately to create a magnificent transparency. Gold leaf speckles many of the Chagallian scenes. Skybirds and wings represent the flight from oppression. Images of sperm, eggs and blood and the artist looking out from a disintegrating fortress echo the theme. The representation of pyramids and the protective eye of Horace of Egyptian Mythology confirm the function of the art piece as power object. Colette's pendants in the shape of a hand developed as an alternative to traditional pendant shapes and represent the power symbol of the craftsman. Colette breaks artistic tradition by using cloisonne for expression, not decoration.

*Colette, "Winged Bracelet," enamel with opal.*

**COLETTE AT JULIE: ARTISANS' GALLERY, Feb. 16 to March 8**

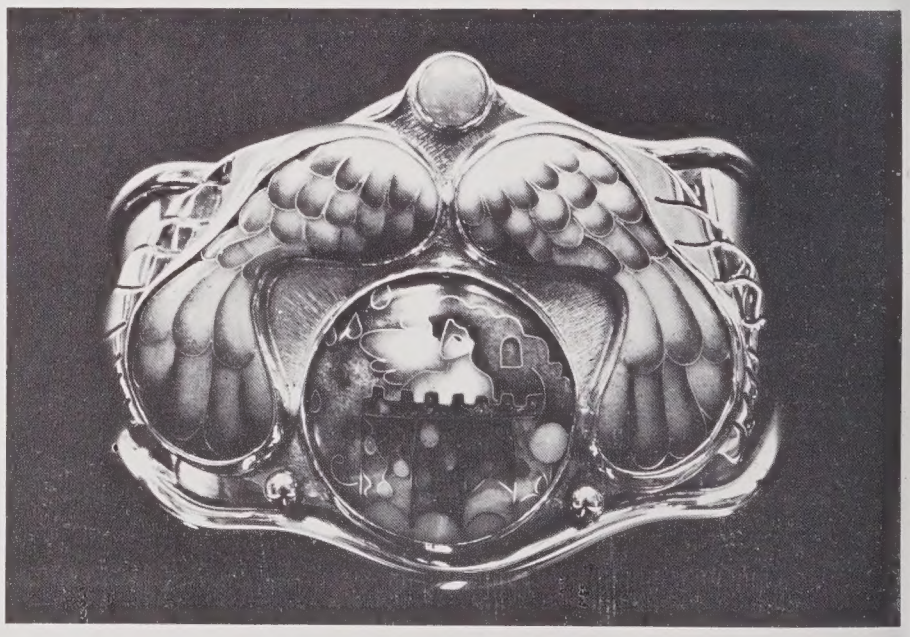
by Ellen Backer

Colette's work derives from her desire to state in visual and palpable terms the paradoxes of life: exaltations and sorrows; tension and relief; rationality and passion, physical as well as metaphysical. For all the intense care given to her work it is when she is able to transcend the mechanical limitations of her art that she feels at her most creative and in touch with artists who, since early times, have expressed themselves in enameling.

For her bezels and cloisonne wire she uses either very fine silver or 24 karat gold. Commercially milled cloisonne and bezel have a very limited range of sizes. Colette prefers to mill and draw it out herself, so that she has the variations needed for her specific work.

Her colorings, if comparable to any other living artist, would be closest to Marc Chagnall. Her imagery both mystical and full of whimsey delights the eye and the heart.

Among her many honors are an acquisition for the permanent collection of Marietta College; co-winner of the Following Sea Award, by the Following Sea Gallery of Honolulu, Hawaii; the Prix d'honneur du Jury at the 4th biennale internationale at the Art of Enameling (L'Art de l'Email) Limoges, France. All these in 1978.



**PENSACOLA NATIONAL CRAFTS EXHIBITION–March 9-30, 1979**
**Visual Arts Gallery, Pensacola Jr. College, Pensacola, Florida**

**by Allan Peterson**

A full one-third of the 100 artists accepted for this show were metalsmiths. Reflecting the diversity that a national should have, the entries ranged from traditional strengths like Caleb Sullivan's graceful raised silver-copper "Chalice No. 2," to the whimsical fancies of Jim Cotter's "Greasy Spoon."

The most memorable works were characterized by a high degree of almost virtuoso craftsmanship. Notable in that regard were works by Carol Kumata, Richard Palmer, William Strickland and Martha Glowacki. Kumata's "Untitled Pin" in silver and copper had a back that was as carefully considered and worked as the front, a delicate landscape with cast twigs. A fine oriental sense of color and texture contrasts was heightened by her use of paper in this piece, and straw in her equally deserving "Wrappings" which evoked aspects of samurai armor. The copper, brass and leather purse by Ms. Glowacki was accented by mokume units on the lid and chain, setting off nicely the dark leather and matte-finished metals. Mokume also appeared in the handsome watercolor knife of Marvin Jensen.

Though little gold was in evidence, the best of it was two neckpieces and a pin by Robert McCall, beautifully colored with chemical patinas, set stones and ivory.

Intricate was the word for a "Cityscape Container" by Sharon Tuke. Inlaid copper and silver were the basis for this lidded container but the decorative details were so diverse and appeared on every surface inside and out that it was difficult to display to advantage, but a joy to discover. Amy Davison's concern was the use of cast and carved epoxy as an adjunct to traditional metals in jewelry. Color is very important to these works. The green brooch was particularly effective.

A nice balance existed between useful pieces and those beautiful objects meant for pondering. Some in the latter category were made by Rosemary Gould whose silver and coopercook "Mon Belles Arbres" contained three photos printed on silk and a mokume flyleaf; Timothy Maddy's "Object;" Sandra Green,

*Rosemary Gould, "Mon Belles Arbres," silver, copper & silk, 4" h.*

*Sandra Green, "Mantid Mountain Mauler," silver & delrin, 5" h.*

whose "Mantid Mountain Mauler" reminded one of the next evolutionary step of the Swiss Army knife; or Hale Anderson's acrylic and copper "Aspersorary." The answer to how to get kids to eat repulsive vegetables was provided by Alan Mette's silver spoon with wings and landing gear called "Open Wide Baby."

Some of the other craftsmen represented were Al Ching, Ruth Fuhrmann, David Holtslander, Janet Ryan and Beverly Sahn.

Purchases from the exhibition to become part of the permanent collection of the college included a pin by Robert McCall, while Hale Anderson, Martha Glowacki and Carol Kumata were invited for a group show next year.

*Caleb Sullivan, "Chalice No. 2," silver and copper, 11" h.*

*(photos by Jim Threadgill)*

## MARY LEE HU "WORKS" 1964-79, THE FRED P. GILES GALLERY EASTERN KENTUCKY UNIVERSITY, Feb. 4-28, 1979

by Sarah Capps & George Arndtt Civey, III (Butin-Chauvigny)

The mounting of an exhibition which is retrospective in nature almost invariably is greeted by both critic and viewer with a certain amount of anticipation, for it is only in this type of situation that one can see where the metalsmith has been and where the development of a stylistic path has led. Ms. Hu's idiom of wire for which she is well known was well represented, but there were also sculptural works. The wire works, though — whether woven, looped, knitted, wrapped, plaited, or encased in sheens of lacquer — assumed the shapes of insects and animals, but were the most successful in the neckpieces and headpieces.

It is obvious that the essence of Ms. Hu's style is line. This line though, is not conceived in the normal graphic sense of the term, but is a much more complex mechanism. Her production evinces the dynamics of a definite comprehension of the phenomena of time-space relationships so loved by our own century. Ms. Hu's line is in a sense time and the passage of the reflective diameter through the necessity of space a path. Light passage caresses and activates the refractive possibilities implicit in the metal and achieves visual passages of the highest sort. The activation of the refractive necessity of the 24 karat gold and its polarity plain electrical wiring are, of course, accomplished by the movement of the eye. This is true as one approaches the display cases where the objects are viewed; but is even more convincing when seen on the human figure in motion where it is obvious the pieces were intended to be worn. In other words, Ms. Hu's works stand out in great contrast to a large majority of her contemporaries who have seemingly set out to create museum pieces and display objects that look quite stunning in their displays, but which could not be worn. The reflective effects of Ms. Hu's time-line constructions are so aptly put together that the type of light which would be called upon to activate them is quite immaterial. The throbbing cacophony of disco-boogie timed strobes and string lights blinking in diagrammatically reserved progression do not harm them. The sweeping movements of the gentle sway of a waltz at three o'clock in the morning when the candles are but nubs in the crystal and gilt sconces would probably show them to the finest advantage. The pieces call for someone to put them on, and that in the realm of fine jewelry is the highest compliment that can be paid them.

The polarity of the precious and the non-precious, the contrast of the gold with electrical wire places Ms. Hu in the 20th century. She is willing to abjure to some extent the advice of the anonymous author of the *Libri Carolinii* who would demand that preciosity of materials is necessary to convince man of their desirability. Where would our civilization be without electric wiring. To us this is the precious commodity. Doubtless the ductility of the passages in this polarity of metals enhances the inherent and natural symmetry of their union. Perhaps the success of her neckpieces and their willfull demand to be worn depends on even a more disarming and ultimately sensible practicality of design that the goldsmith should never forget and that is symmetry. When the artist says "It seems to me that when a piece falls over two collar bones and between two breasts that it (the piece) must also have two sides," she means natural symmetry.

In relation to her method of accomplishing her designs Ms. Hu is quite frank and honest. A comparison between her preliminary drawings and a finished object is informing as a quick perusal of the accompanying drawings and photographs will make apparent. The common visual assumption that some have made in relation to an extensive background in thread and fibre are belied by her own admission that she only studied those techniques in one course in her collegiate training. When asked about her method of design it is interesting to note that she does use preliminary drawings in a most unique way. The insect and animal pieces in the current exhibition required many drawings from various angles so that she might become more familiar with the creature and its essential characteristics. The drawings were self-consciously undertaken to improve her skill in planning. The neckpieces were initiated in terms of diagrammatic necessity. Sketches of cross sections of the work were used as plans for the wrappings and as patterns of weaving. Surprisingly enough, though, she admits that the more complex the work the less drawing was involved. The piece became in her own words "a discovery." It is in these more complex pieces that her sensitivity to the material becomes apparent. The artist knows her material well. As she puts it "silver wire feels different from copper wire."

*Mary Lee Hu, Neckpiece No. 15, fine & sterling silver, lacquered copper, 15" h, 1974.*

Ms. Hu uses her materials expertly utilizing the qualities of each and every strand to its fullest capacity. When looking at the works, it is not so much the amount of materials used, their preciousness or non-preciousness, that makes them unique. It is the manner in which they have been handled which give the objects their jewel-like quality. As she says, "I had rather the pieces be precious because of what I have done to them rather than because of their intrinsic value."

*Mary Lee Hu, Choker No. 39, fine & sterling silver, 14k gold, 8" w, 1978.*

The pieces reflect what she has done to them most successfully in the imagery that she employs which is ultimately humane. She is continually searching for vehicles which will allow her further exploration of the linear qualities of wire. This search has fostered an avid interest in the jewelry of whole ethnic groups, particularly tribal or prehistoric in nature. Within this context, she is especially interested in how a culture came to resolve various solutions to problems in body ornament — problems that jewelers still face. Ms. Hu is also very interested in natural objects—small sea creatures, veinings in leaves, mold formations, microscopic organisms and objects which create textural line. In keeping with her search for imagery, the influences of her years in Taiwan become apparent in the images of dragons and the Phoenix which appeared in her work at this time. Certainly the sexual polarity implicit in the binome feng huang as it pertains to the Phoenix was not lost on her. This, coupled with the influence of the elegant calligraphy of Chinese and Tibetan art, have made her works—particularly the neckpieces—less massive and more fluid in line as her work progressed through time.

When viewing the show as a whole one is struck by the concept of majesty in many of the pieces. In an era in which much art self-consciously points out that which is ugly in our society and in nature, it is refreshing to find an artist who is interested in beauty. Line soars gracefully coruscating through space. Surface and texture created by the use of materials gleam richly. Each piece titillates the eye in the most pleasant manner. It is fortunate the artist is working in a media which allows her to be decorative without being considered trite. Indeed, when dealing with art that is worn on the body, it is almost expected that the works emphasize in order to enhance their appeal as jewelry. At any rate, it is the feeling of the artist that we need this emphasis on beauty now, perhaps more than ever before.

When asked to verbalize about her work, Ms. Hu displays an attitude prevalent to many artists. She feels no special need to talk about her work, but has been asked to talk about it so frequently that she has become quite adept at this exercise. However, her primary attitude is "let the work speak for itself. To describe a piece is to do it over again, and it never turns out the same." Her works speaks for itself.

## INDIANA UNIVERSITY SHOWS– MS. EIKERMAN TELLS

**by Christopher Hentz**

We at Louisiana State University in Baton Rouge are proud to say that now, with the wisdom and support of the 3-D area faculty of the Fine Arts Dept., Jewelry/Metalsmithing in Louisiana is moving in a positive professional direction.

This spring marks the first time that the jewelry/metalsmithing classes have occupied an honest studio (as compared to the "make-believe" studio for the past nine years!). Along with the facilities, tools are slowly accumulating.

Needless to say, the best measure of support is $$. To further support the jewelry/metalsmithing area, the community and the Art Dept. granted the jewelry/metalsmithing area a spot in their annual Spring Museum-Lecture-Workshop series. For jewelry/metalsmithing, the series involved a two-day workshop, a public lecture, and a month-long invitational show in the museum.

In order to educate the public and promote metalsmithing here at LSU and, upon hearing of the retirement of Alma Eikerman from teaching, we decided to invite this master craftsman/educator. On March 6, the LSU Metalsmithing Invitational: Indiana University show was mounted. It was an excellent survey of Indiana University metalsmithing which included some present graduate students, several past graduates, as well as Ms. Eikerman. The show was professional in every sense of the word. All pieces exhibited craftsmanship of the highest quality; the powerful diversity of design senses and functional characteristics of the pieces were apparent among the artists.

Over the years, I have often heard of the IU design stereotype. This being one of few all-IU shows, the invitational unmistakably disproved the monogamy of IU styles. The outstanding 52-piece show included holloware and jewelry by: Richard Bauer, Leslie Brown, Kathy Buszkiewicz, Cathy Eid, Susan Ewing, Jacqueline Fossee, Marilyn Griewank, Debra Gold, Susan Hunt, Adine Kaufman, Bail Larson, Lynda LaRoche, Leslie Leupp, Kris McCusker, Marie Nicolai, Kathy Rayl, Norman Scutt, Jack Silva, Lin Stanionis, Billie Theide, Alexis Elizabeth Wreden, Sibylle Ulsmer, and Alma Eikerman.

This exhibit was triumphant in bringing people from all over Louisiana to see what the contemporary silversmiths are doing. To this extent, the show was a huge success.

On March 21 and 22, Ms. Eikerman arrived in Baton Rouge with a busy schedule. Up at 6:30 a.m., with hammer in hand, Alma demonstrated various methods of forming metal, including stretching, crimping, and seaming. With students participating, Alma explained common errors, along with some "magic" to aid the forming processes. Students from all areas, including ceramics, painting, etc., proceeded to understand the plasticity of metal.

Ms. Eikerman's visit to LSU will prove to be especially productive in promoting jewelry/metalsmithing in Louisiana. Needless to say, the educational value of this exhibition and workshop will further improve the technical knowledge, visual sensitivities and creative thinking abilities of the LSU students as well as the general public.

As one student remarked, "She really can swing . . . a hammer!"

*Alma Eikerman, Bracelet, silver and gold*

**JEWELRY AND HOLLOWARE BY WALTER AND MITSUKO SOELLNER AT THE SAN JOSE MUSEUM OF ART, March 20-April 29, 1979**

**by Douglas Steakley**

*Mitsuko Soellner, comb, damascene (left)*

*Walter Soellner, Candle Holder, sterling with cloisonne enamel (right)*

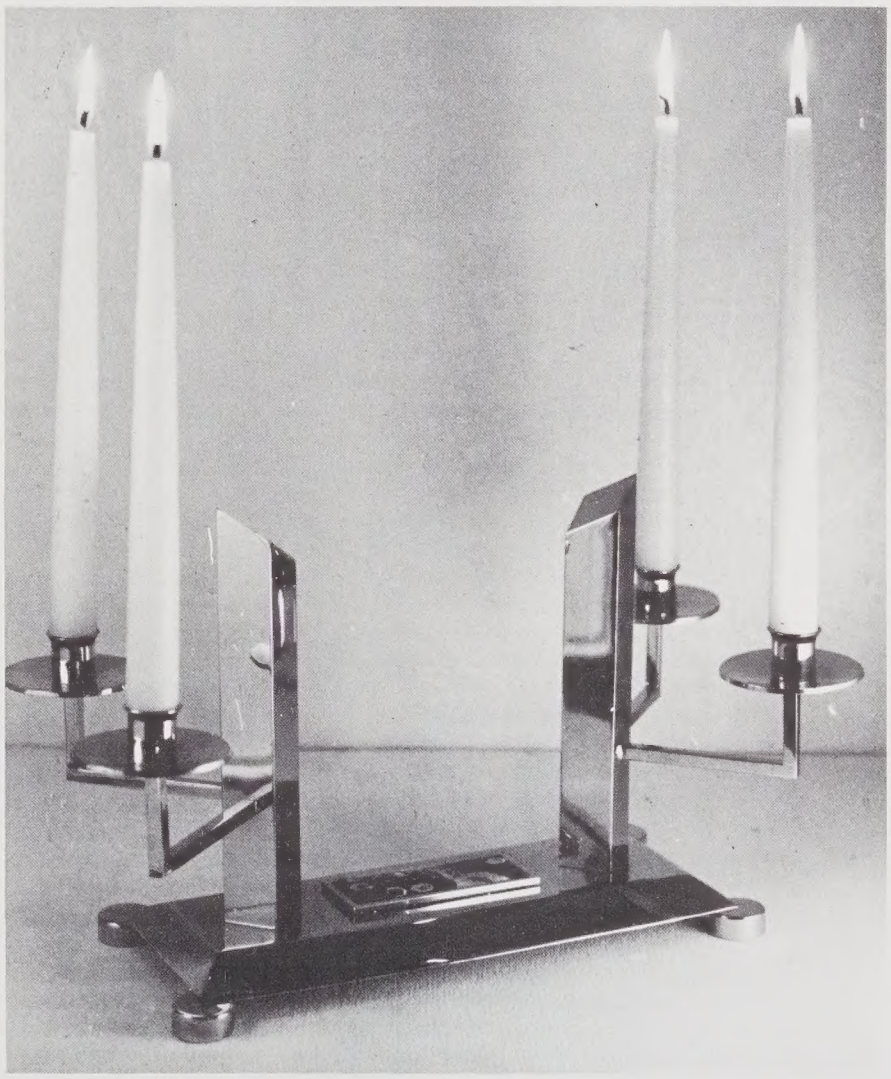
It is always a pleasure to see an exhibition of new and unexpected work. Walter and Mitsuko Soellner's collection of jewelry and holloware at the San Jose Museum of Art includes some older pieces, but more importantly, a large portion of the show is comprised of objects that have been recently completed. A comparison between the two is informative. There is a shift away from the impersonal, academic emphasis on large scale and straightforward shapes to smaller, more personalized statements. The new jewelry and holloware pieces are lighter in feeling, graphic in design and attention is paid to detail and the interplay of color and form.

The highlight of the exhibition is a series of new pieces by Mitsuko using a technique called damascene.

With this technique areas of soft steel are graved out and thin sheets of silver and gold are hammered into the roughened, recessed areas. The steel is then oxidized black or brown, providing a sharp contrast to the inlaid metals. The effect is both lyrical and graphic. Mitsuko learned this process during a recent visit to Japan where she was the first student to study with a Japanese master. Her combs, bracelets and pendants are bold in form, yet wearable and richly detailed. Several of the damascene pieces utilize traditional Japanese motifs, but many incorporate a more westernized, linear pattern.

Walter's work includes several new holloware pieces and a selection of cloisonne and champleve enamel pendants and plaques. A silver candlestick holder incorporates an enamel plaque as a decorative element which adds color and a focal point. Egyptian motifs used in the enamels allow him to explore smaller, mystical designs with the liveliness of rich coloration.

The Soellner's new jewelry reflects a refreshing trend among many American jewelers — the evolving away from an academic conception of jewelry as a three-dimensional exercise into a European attitude of jewelry as wearable art. Within this smaller scale each piece makes a strong and singular statement.



**"VIVIANE D'ADESKY"**
**The Elements, 766 Madison Ave., N.Y., NY 10021**

*Viviane D'Adesky, Shell neckpiece*

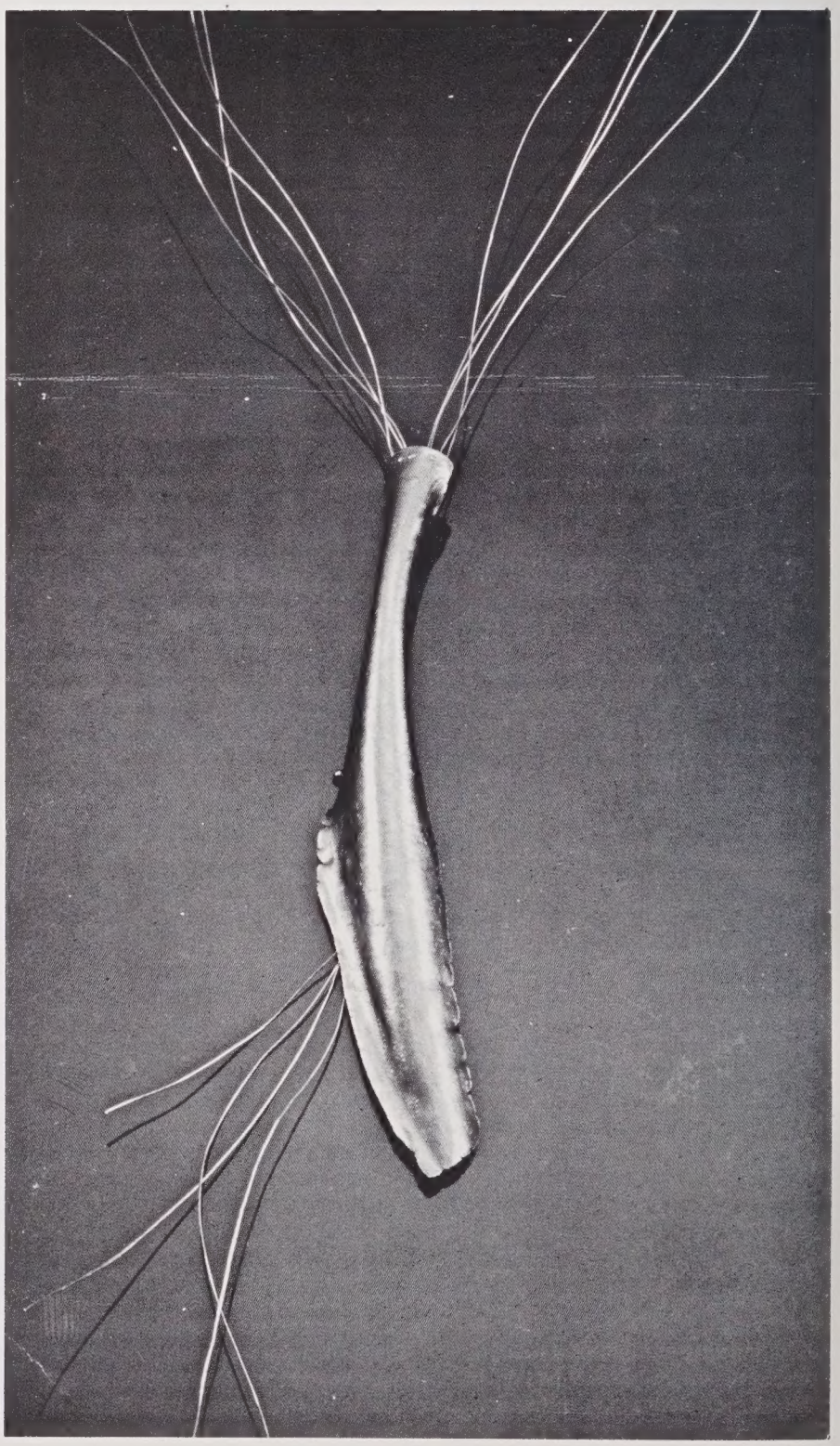
Always striving for new forms and ideas, VIVIANE d'ADESKY has created a striking collection of contemporary jewelry. Combining earlier interests in sculpture and painting, she has found this wearable medium to best reflect her appreciation for nature.

With inspiration from nature's ever-changing forms, colors and textures, d'Adesky uses a variety of its materials to create personal expressions. A neckpiece and bracelet, for example, highlight tortoise shell, gold, ivory beads and coral in a sophisticated contemporary setting reminscent of a seascape.

Viviane d'Adesky fashions a large amber pendant with a neckpiece of acrylic in an unorthodox, yet very elegant combination. Also in her collection are sterling silver rings with malachite in sculptured modern designs.

Educated in France, d'Adesky is currently living in Florida, where her work is exhibited frequently, and has received many awards.

*Richard Fishman, neckpiece, 24k, 1979.*



## RICHARD FISHMAN "BODY SCULPTURE" at HARCUS KRAKOW GALLERY

Body Sculpture, the collection of artists' jewelry at the Harcus Krakow Gallery, proudly announced an exhibition of recent works by Richard Fishman, which opened April 14.

Born in Cambridge, Fishman was educated at Boston University, Yale University, Rhode Island School of Design and Tulane University. He is currently Professor of Art at Brown University.

Fishman is a sculptor of distinction whose works have been exhibited steadily since the early sixties. As a creator of large-scale works, Fishman has progressed thoughtfully through the vocabulary of post-cubist sculptural assumptions, and matured into a richness of concept and purity of execution which is thrilling, evocative, and utterly his own. Paradoxes of fragility and strength, gravity and weightlessness abound — surface, mass, and color are harmonized and inseparable.

Fishman's 24-karat gold jewelry is an integral and important part of his work. Not merely tiny wearable maquettes, the gold work is an authentic sculptural exploration of intensely focused sensation. In this precious material and intimate scale each mark and fold becomes crucial; the smallest and most subtle gesture demands attention, and the forms themselves are charged with rich and complex mysteries. Feathery, light, glowing with warmth, and delicate with incipient movement,Fishman's works are true treasures.

## ARENTZEN THE ELEMENTS GALLERY
**Greenwich, CT**

**by Kay Eddy & Sue Fox**

Glenda Arentzen, internationally acclaimed New York goldsmith, was one of four artists invited to exhibit in a mixed media group show opening March 20 at The Elements Gallery. Ms. Arentzen's work has been shown at the Corcoran Gallery and The Smithsonian Institution in Washington, DC.

On view in the jeweler's gallery were the cast and fabricated designs in gold and silver. In this second exhibition at The Elements, she reaffirmed her dedication in individuality of expression and to total wearability. "Even my classical pieces look unique," she says, "because I believe one should invest in really distinctive jewelry which will become the heirlooms for future generations."

One of this country's most highly regarded jewelry artists, Arentzen's work is abstract and sculptural in concept, embodying a unique feeling for line, form and texture. Arentzen's works have been widely shown in fine private and university galleries and museums.

## REVIEW OF GLENDA ARENTZEN
**Vitti Gallery, 594 Valley Rd., Upper Montclair, NJ, Oct. 4-28, 1978**

**by Pahaka**

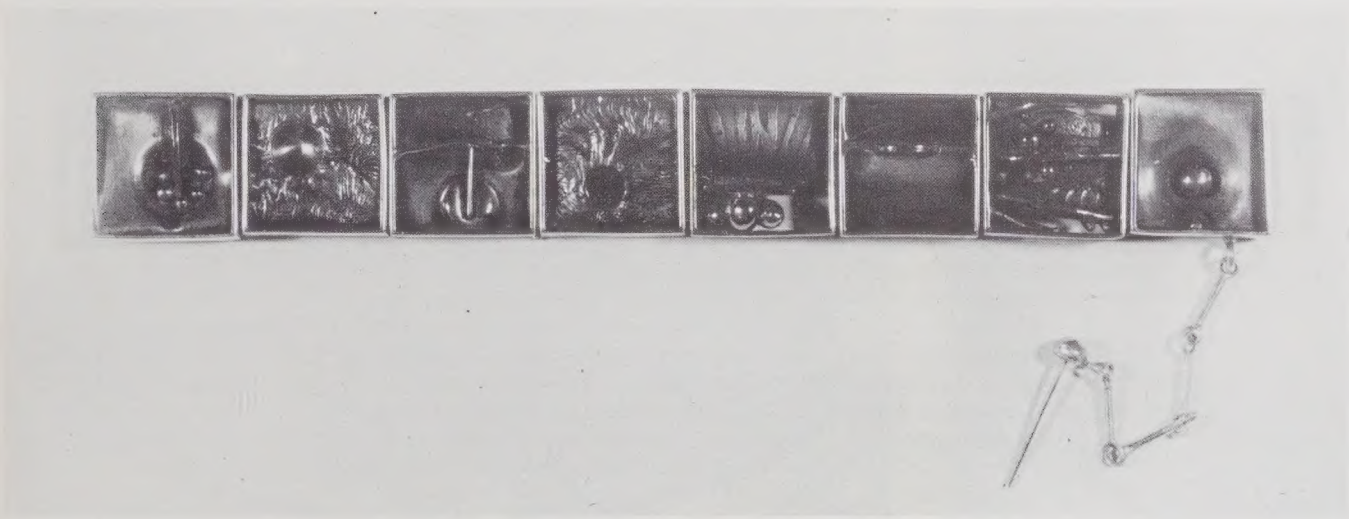
The Vitta Gallery is located in a wealthly suburb of the New York Metropolitan area. The owner, Vitti Van Cleef Stein, loves jewelry so she is able to represent it enthusiastically. She carries approximately 80% jewelry and 20% glass, porcelain and various other crafts.

Owing my own jewelry beginnings to Glenda Arentzen, and assuming most everyone is familiar with her work (due to recognition from numerous awards, articles, exhibitions, workshops, etc.), I will try to say what has not already been said before. Glenda showed over 50 pieces of work, ranging from the "safe" to the "experimental outrageous." One person viewing the exhibition remarked there should have been only major pieces in the show — however, I disagree. Many persons are unable to afford the piece of their dreams or are uncomfortable with one-of-a-kind exotics, and her smaller, simpler jewelry was designed to appeal to this more conservative class.

Her one-of-a-kind pieces seemed to grow abstractly out of a true design sense that sets her apart from the rest and contributes to her success. In each piece there is always some element with that extra ZING that makes it outstanding. Glenda approaches color with caution, yet control. Colored golds are used for subtle variations and her transparent stones and crystals blend with the piece, yet differ in texture. Blacks and greys are combined with the gold to create depth. Small areas of engraving, fusing or overlayed forged metals unite harmoniously with smoother wedges to form the finished concepts.

Glenda's design elements share a strong similarity with her graphics and are called upon with comfortable familiarity. In her jewelry work, she casts, forges, constructs or uses any number of combinations, but they always come solidly organized from Glenda's own world.

*Glenda Arentzen, bracelet*



**FIRST HAWAII METAL CRAFTSMEN SHOW**
**Gima's Art Gallery, Honolulu**
**March 4-24, 1979**

by **Gertrude S. Hornung**

*Carole Bowen, "Helmet Box," pewter & brass, 5"*

*Frances Pickens, cannister*

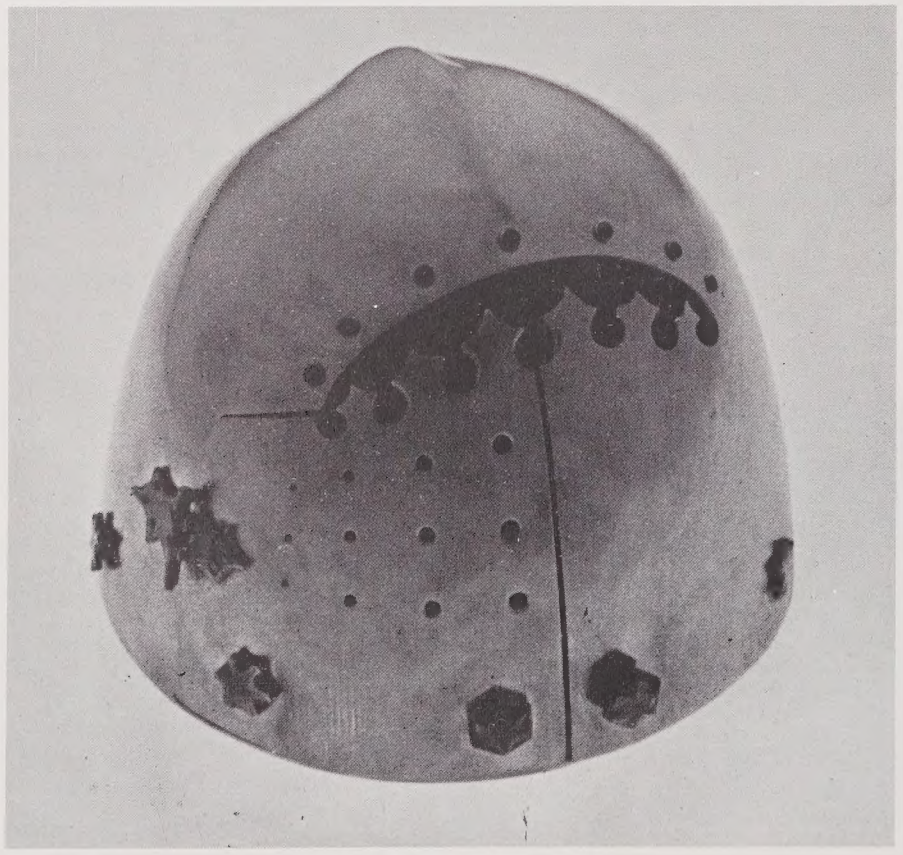
Fifty-five works by eight artists comprise a small show of great importance, entitled "Gold, Silver, Copper, Brass," displayed March 4-24 at Gima's Art Gallery, Honolulu. The impetus for the exhibit was to reveal the range of technical achievement towards excellence marked by originality, wit and beguiling charm by the first cooperative effort of metal craftsmen in Hawaii.

Innovation in technique and individuality in style create surprises that intrigue and interest. Defying "women's lib" in discussing ladies first: CAROL BOWEN's works are inspired by medieval armor, hence the concept of defense—including that in nature, plants and insects—plated, spiked and shielded. Her silver and gold "Four Straws" has four knobs, the ends of the tapering silver spikes set into a semi-globular receptacle; her "Helmet" is also beautifully crafted. BARBARA ENGLE has subtly refined silver and ivory pendants and rings.

FRANCES PICKENS presents utilitarian forms such as canisters, boxes and belt buckles—as well as forged neckpieces. Her choices of materials, except for silver, are aluminum, brass, bronze and copper, and the viewer is surprised by the goldsmith's refined methods as applied to baser metals. Her verdigris copper canister whose lid, a repousse face, is unforgettably evocative of ancient images. DONNA STONER likes to juxtapose the soft flowing forms of organic materials like shells with the hardness of metals. This challenge is well resolved in several sterling necklaces that combine free form in cloisonne enamels and shells. LANI WARREN views her works as small sculptures that may be worn. She employs silver, uses "mokume gane" technique of layering metals, and combines ivory, ebony, pearls (white and black), quartz and jade for original effects in rings, pendants and necklaces.

The three men are strongly represented. RONALD AI has many finely wrought pieces of which two pendants are the most distinguished: "Moon at Sunset" and "Tree at Sunset," executed in silver tracery over translucent carnelian set in silver. LORENZO CELIZ has many rings and earrings in original and mysterious shapes in which he uses varied materials: silver combined with pearls, opals, diamonds, moonstones, azurite, lapis lazuli, abalone shells and Burmese jade. MICHAEL TOM enjoys the process of forming metals: stretching, raising and manipulating silver and copper into complex constructions.

The competence of the "Eight" is verified by four having graduate degrees in Fine Arts. Some, like Frances Pickens, are experienced exhibitors and nationally recognized; others are known chiefly in Hawaii. The line between crafts and fine arts cannot be drawn by their works. It is a brilliant show of high quality. The distinguishing marks—the "I.D." of the group—are integrity and discipline, forecasting a fine future for Hawaii's metalsmiths.



## REPORT ON SNAG EUROPEAN EXHIBITION

**by Richard Helzer**

*Jacqueline Fossee, Metal Object (left)*

*Eleanor Moty, Purse, silver, leather and moonstone (right)*

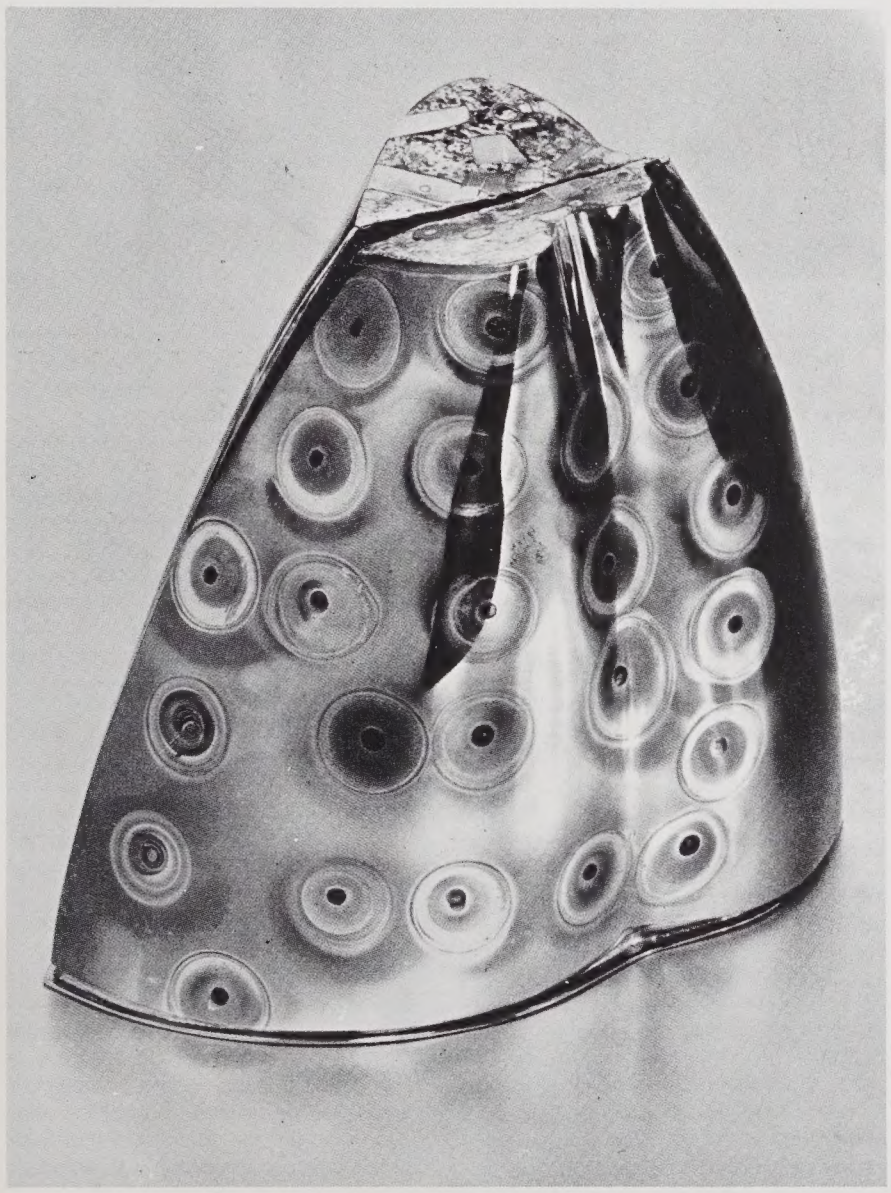
On March 9, at 6 p.m., the Society of North American Goldsmiths' Jewelry and Metal Objects Exhibition opened at the Schmuckmuseum, Pforzheim, Germany. The opening represented the culmination of much hard work between our organization and the museum staff, particularly Dr. Fritz Faulk, Museum Director.

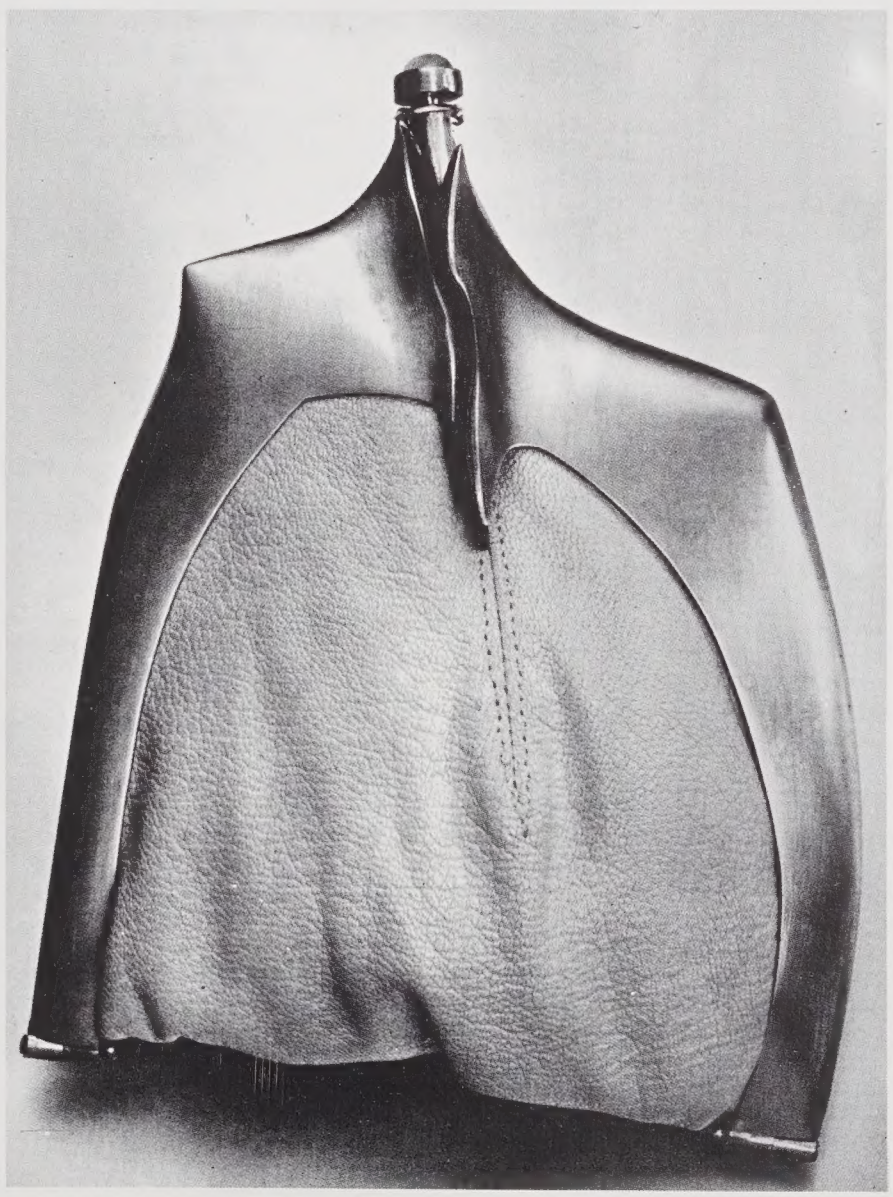
Representing SNAG in Pforzheim, I attended the press conference on March 8, and the opening of the exhibition, March 9. My overall observation of the show was very positive — it was the typical, well organized, beautifully presented show that marks each event at Schmuckmuseum. The catalog and publicity seemed satisfactory with only a few errors, mostly in translation.

I arrived at the Museum on Thursday morning and had an hour briefing before the 10 a.m. press conference. The conference was held in the Gallery with about 12 newspaper, magazine and television representives present, including the two important German goldsmithing magazine representatives. Dr. Faulk made a formal presentation concerning the organizing of the exhibition and I attempted to answer questions and give general background information on SNAG and its purpose. After lunch, I met with the art editor of the large Frankfurt newspaper — a woman very knowledgeable in contemporary work and a friend of Claus Bury. She was extremely thorough and asked questions about each exhibitor.

At this point, I would like to say something about the show itself. The Goldmuseum is a two-story building with equal sized galleries on each floor. Our exhibition was on the 2nd floor, as are all special shows. Installation of the show was meticulous and the overall effect very impressive. Each artist's work was displayed in a showcase all his own. The cases are either built into the wall or hung from the ceiling. The gallery walls are black, general lighting dim, with each case being illuminated from within — a spectacular effect. All the installation was done by Dr. Faulk and one assistant.

The official opening was on Friday, March 9, at 6 p.m., by private invitation. This was a formal affair with approximately 200 in attendance. The evening began with opening remarks by the Mayor of Pforzheim, followed by a speech by Dr. Faulk,

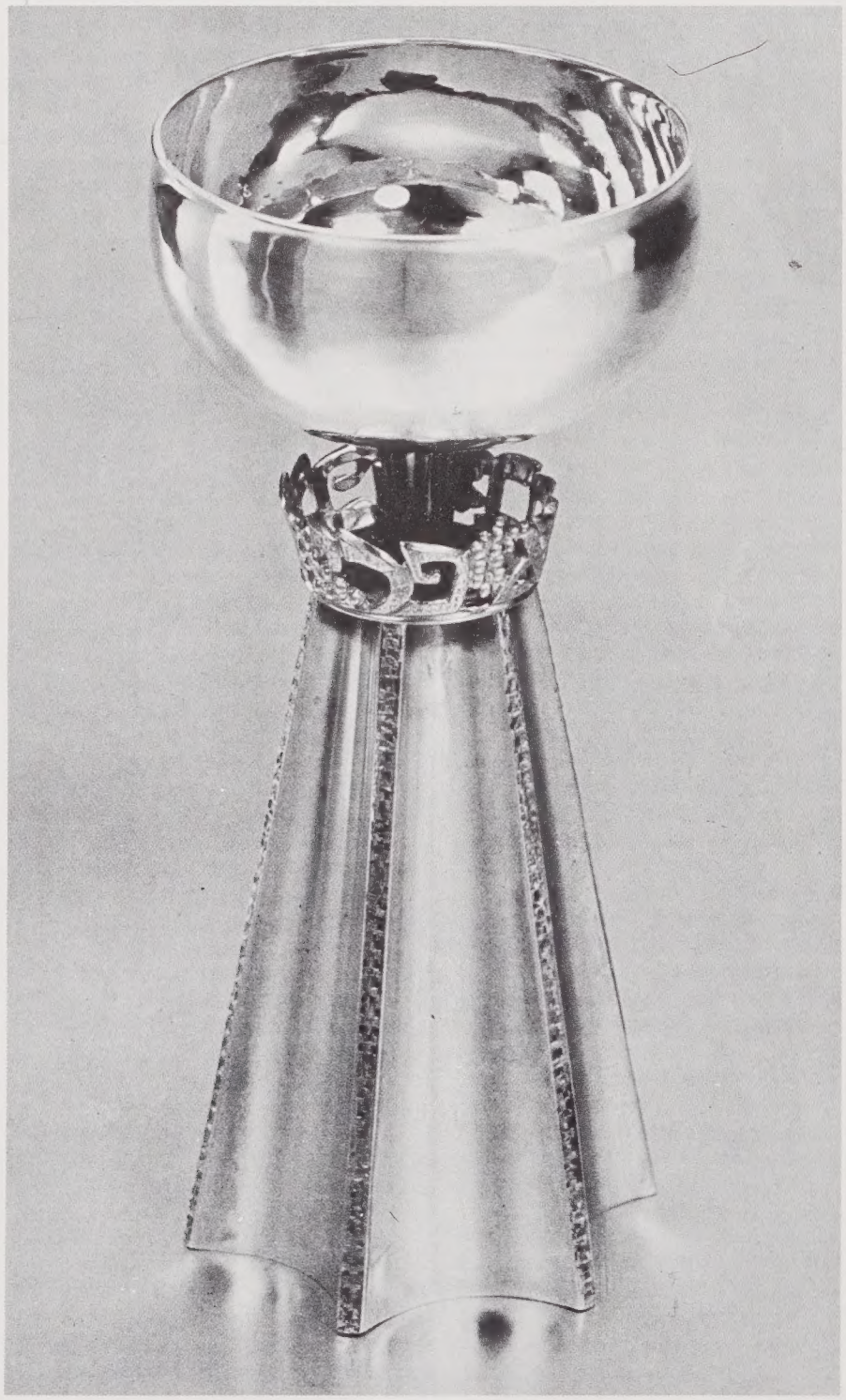




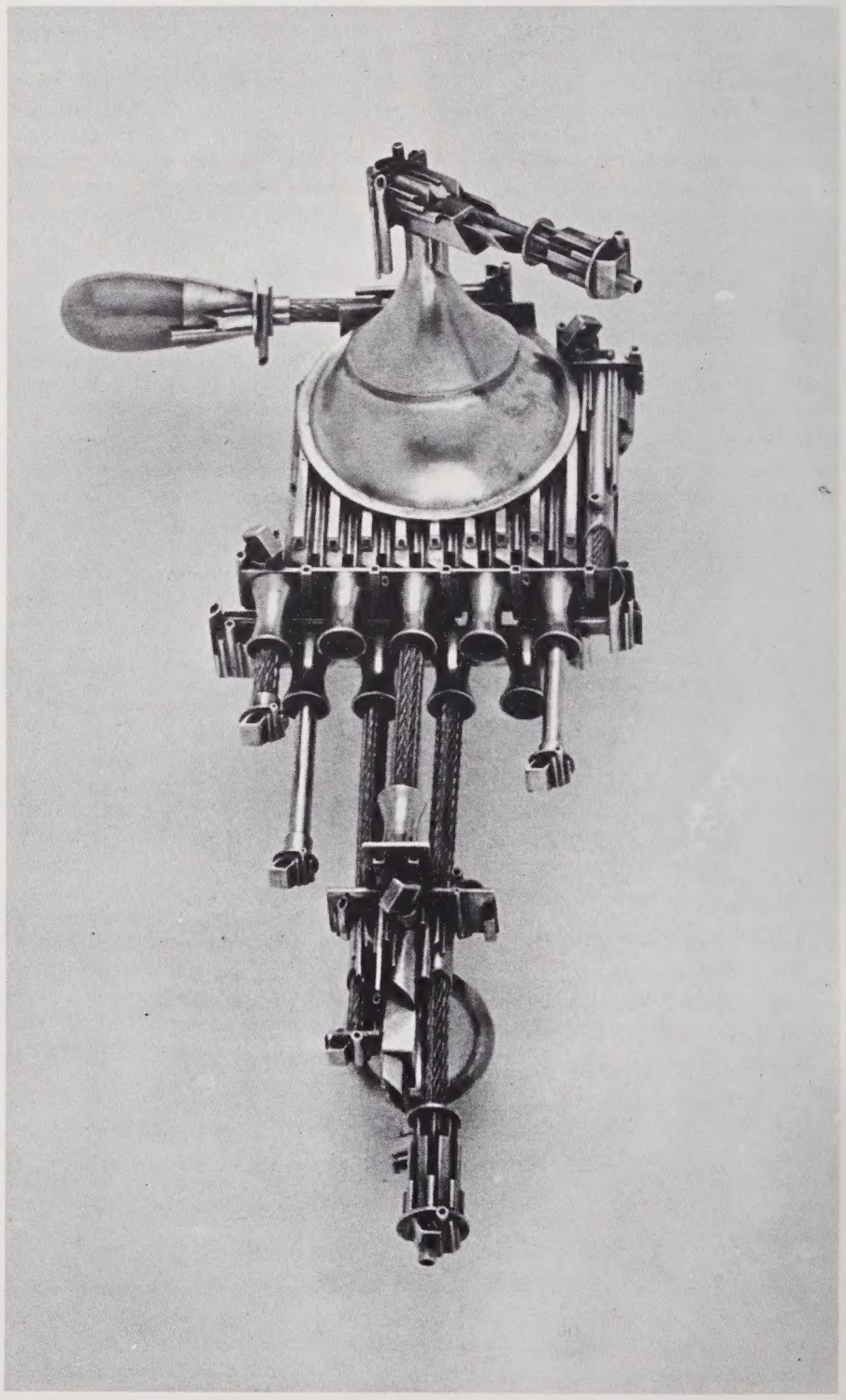
and general comments by me, translated by Claus Bury. The opening was attended by the U.S. Consulate to Germany and various city officials of Pforzheim, as well as European metals people like Max Froehlich from Zurich, Claus Bury, Reinhold Reiling and others. The public opening was March 11, and the show ran until April 16, when it moved to the Deutsches Goldschmiedehaus, Hanau.

As this is the first group presentation of American gold and silversmithing in Europe, it will be interesting to follow reactions as it travels across the continent. Whatever the response, I feel important ground has been broken and everyone seems anxious for a greater exchange in the future.

*Kurt Matzdorf, Kiddush Cup, silver*



*Richard Mawdsley, Brooch, silver and jade*



**SHARON CHURCH**
**The Elements Gallery, 14 Liberty Way, Greenwich, CT, April 24-May 26**

Sharon Church's romantic and undeniably opuent jewelry, on view at The Elements Gallery, summoned visions of pirate booty chests heaped with splendid and fabled treasure. Her most recently designed collection, while closely linked with current fashions, clearly establishes her own artistic statement.

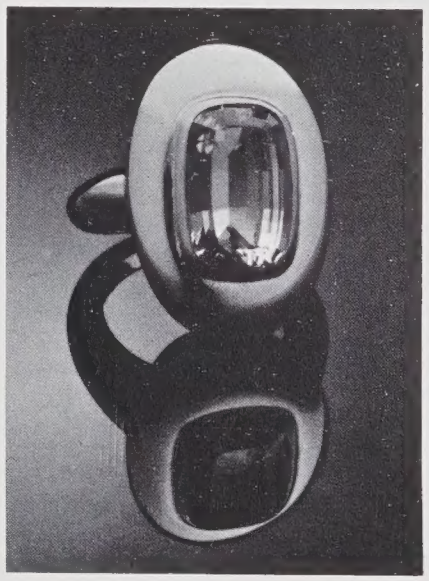
Colors dazzled the eye . . . ropes and chokers of pearls, carnelian, onyx, and amber were fastened with large handsome sculptural clasps or hung with free-form pendants. Some were sleek, of highly polished silver, while others, in dramatic contrast, were fabricated of darkly rich and bold silver fused and patterned with gold.

There were wide dramatic cuffs and pins executed in this fascinating and exacting "married metals" technique, as well as bangles of gleaming silver. Stunning rings were set with semi-precious stones. In each unique piece, the artist's vision was apparent and her craftsmanship unexcelled.

Elegant, romantic, yet reasonably priced, these sumptuous works will be the treasured heirlooms of future generations. A Delaware metalsmith, Church's pieces have been shown nationally in many prestigious galleries and museum exhibitions.

*Marcia Lewis, Brooches, gold-plated*

*Sharon Church, Ring, topaz and 14k*



## CONFERENCE REVIEWS

*Reed & Barton Tour Group Lunch Break*

### SNAG CONFERENCE, APRIL '79

by Anne Besse-Shepherd

This year's SNAG conference began on Thursday, April 19, with the registration of approximately 350 participants at the Bradford Hotel in Boston. After the business meeting we were off to the Boston Museum of Fine Arts via the M.T.A. At the Museum there were several lectures by museum personnel on their excellent silver collection. We were broken into small groups and allowed to examine, with the help of the curators, a number of antique pieces. In addition, there were several items by Faberge on display.

That evening we all returned to the hotel for a buffet dinner. This was the first real opportunity to see old friends, meet new people, discuss new styles and techniques and just talk and, as a result, I'm afraid the dinner speakers didn't get the attention they deserved. Jonathan Fairbanks, curator of American Decorative Art, spoke on that subject. Sue Mellon discussed the project that she's been working on, a standard contract between craftsmen and galleries. There was also a speech by John McLean of the National Endowment for the Arts.

After dinner some people remained in the ballroom to dance, while those of us who were feeling less ambitious moved upstairs to see some slides and Sandi Zilker's excellent film production about SNAG.

We all gathered Friday morning and were split into three groups for bus trips to The Jewelry Institute, Towle Co., and Reed & Barton. Our group went to Reed & Barton where we were given a tour of their facilities and saw the mass production of silver flatware and holloware. While there was a great deal of interest in the manufacturing process, I didn't see anyone in the group ready to apply for a job. We had a picnic lunch and then we had a few free hours to relax or see the city before we gathered again to listen to a panel discussion by three young designers. Tina Boscarino, Cathy Oblarnsney, and Scott Taber were informative, but at times they seemed quite pessimistic. At the same time that the panel discussion was taking place, James Ward was showing slides of his work using anodized coloration of refractory metals such as titanium and columbium.

Saturday morning we met at the very impressive metal shop at Boston University. We were able to view some of the student work and tour the facilities followed by an informal lunch at the University which afforded us the opportunity to meet the students and discuss the program.

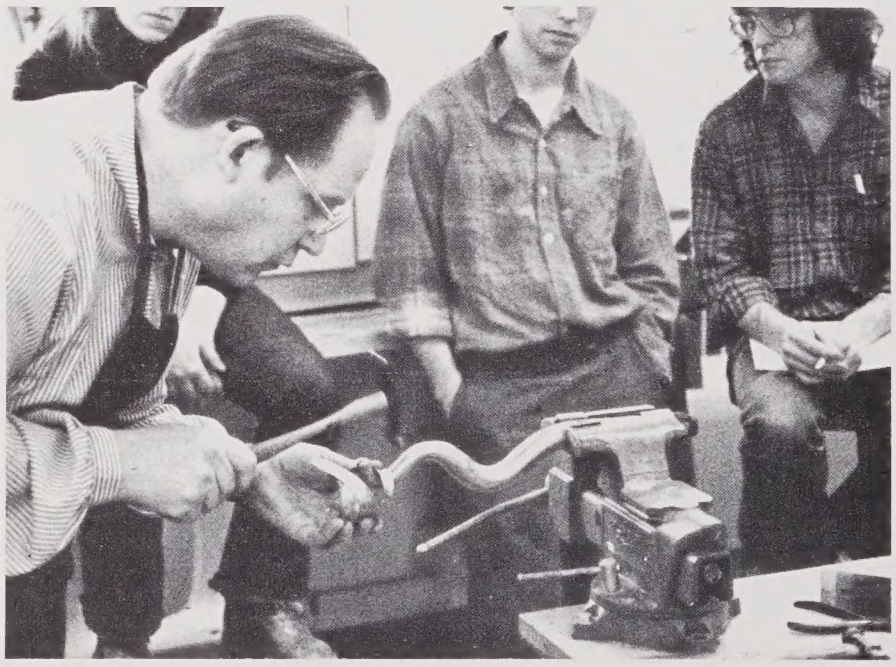
That afternoon there were two interesting and very informative technical papers presented: Joseph Hall, of the University of Washington, discussed the properties and uses of Titanium, Zirconium, Hafnium, Niobium (Columbium), and Tantalum for the Artist/Metalsmith. The other paper was a joint presentation by members of the graduate program at Southern Illinois U. at Carbondale (Marvin Jensen, Phil Baldwin, Steve Brunst, Laurie van Houton, William Ard, Janice Nathan, Randy Jones, and Professors L. Brent Kington and Richard Mawdsley). The title of the paper was *Return to the Forge (Extended Research into Mokume-Gane and Granulation)*.

The conference concluded at the Massachusetts College of Art with a student show, a buffet and, of course, the traditional relay races for sawing, filing and soldering.

This year's conference was both fun and informative and I was pleased to see that there seemed to be more young members attending than in previous years. I did miss having the opportunity to see slides of student work from the various schools and it would have been very helpful to have been able to meet in small groups with others to discuss selected common problems. For instance, discussions with the several gallery owners who were present might have been very interesting.

I very much missed a SNAG show although I realize that such a show is a very major undertaking, but a number of the members live in areas that don't often see such shows. As always, the conference has sent me back to the studio with new ideas inspired by the contact as well as the programs and, of course, that's what it's all about. Thanks to all the people who gave their time so generously so that we could both learn and enjoy. Special thanks to George McLean, the coordinator, for the conference.

*Heikki Seppa working on helix (photo by Sarah Schaffner)*



### HEIKKI SEPPA CONDUCTS SHELL FORMING WORKSHOP

by Ron Wyancko

Heikki Seppa, professor of art at Washington University, St. Louis, MO, conducted a workshop sponsored by the Virginia Crafts Council at James Madison University Metals Department March 6, 7, and 8. This was not an unusual occurrence since Heikki has conducted nearly 50 such workshops and lectures in shell forming techniques throughout the country. For several years he has been advocating a new direction in metal work; one that places emphasis on new forms and structures created through the technique of using sheet metal to make hollow forms. In order to communicate about structure through form, Heikki has developed a vocabulary of terms describing this new means of personal expression. At the beginning, these new terms were overwhelming to the 20 workshop participants. But, as the workshop progressed it was inevitable that helix, spiculum crese forms, hyperbolic parablolid, synclastic and anticlastic crept into the conversation.

Each morning and afternoon, Professor Seppa would show slides of basic shell structures and work done by his students. Studio sessions involved creating metal forms on stakes made of wood and steel. Each student was able to complete several pieces. Many of these included a soldered deck or cover to fabricate a light, hollow, structurally strong form. These basic shell forms serve as a jumping off place for more complex structures that depart from the monolithic forms generally achieved through raising techniques.

Heikki went on to Washington, DC to deliver a lecture at the Renwick and give another workshop.

It is of great value to the artist-craftsman in Virginia to be able to draw nationally and internationally known artists to the state. Workshop participants and I wish to express our thanks to the Virginia Crafts Council for the opportunity to meet this outstanding metalsmith.

For further information concerning shell forming structures, read *Form Emphasis for Metalsmiths* by Heikki Seppa, published by Kent State University Press.

## BOOK REVIEWS

*CREATIVE JEWELRY: A Practical Guide*, by Patti Clarke
A Studio Vista book, published by Cassell & Co., Ltd., 35 Red Lion Square, London, WC1R, 4SG; 143 pages; approximately $17

**reviewed by Marcia Lewis**

My British friends always tell me they admire the polished formats and presentations of American television. And I always tell them how I admire the same qualities in British publications of all sorts. This book is no exception.

"Creative Jewelry" has an attractive Art-Deco-Type print style and an easy-to-read and follow layout. Some especially nice qualities are descriptions of metal elements with their melting points included, right alongside so easy memorization is very likely. The section on materials and tools includes points on exotic things like Tortoiseshell, Amber and Abalone shell. There is a nice, simple descriptive chart on what color changes are necessary for tempering steel for various different types of tools. And the hardness chart on the most frequently used stones is always good to have in a book of this kind.

There are a couple of tricks I learned to use while living in London in 1972. One is a scraper, formed from a flat file, and is far superior for removing metal for a 90 degree bending of sheet than the tool which is commercially available in this country. Page 63, figure no. 20, has a nifty method for holding tiny bits firmly alligned for soldering by using plasticine and plaster (dental investment preferably).

There are only two negative criticisms I can level at this volume. Patty Clarke was trained at Loughborough College of Art and the Royal College of Art. She teaches and makes jewelry, so these weaknesses are hard to understand. One is a slight lack of respect for safety hazards as concerns things like asbestos and niello, etc. These are taken a little too lightly for my peace of mind, as concerns their use by the inexperienced and vulnerable student. Second is the choice of designs of finished pieces. There is an abundance of little flowers, birdies, and cloud cliches. A tad too trite and "K-Mart" for my taste. Some refreshing exceptions are pieces by Lexi Dick; some familiar Wendy Ramshaw stacking-rings; and some really fine "Lorry" brooches by Rosamund Conway of fine silver combined with yellow gold.

**BOOK REVIEW**
**HANDBUCH DES GOLD-SCHMIEDES BAND I**
**52 pages, $14.00, $2.00 postage**

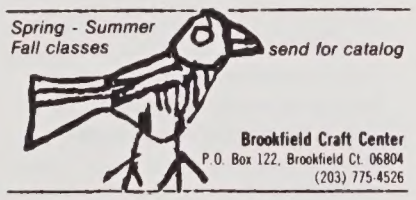
**by Hannelore Gabriel**

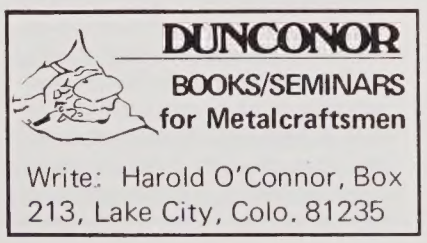
This skinny little book has the best collection of charts I have seen so far. Especially useful I found a chart of yellow and red gold alloys in all karats with recipes of alloy metals, colour, melting point, specific gravity, number of the matching solder, for which there also is a chart and description of the workability of the alloy.

The book contains 54 charts on re-alloying, increasing and decreasing alloys including coin golds into commonly used other alloys often with different colours. At a glance one can see for example that a given amount in grams of 14k pale yellow gold with addition of so many grams of fine gold and copper make so many grams of 18k red gold. The same charts can be found for silver. In addition, there are brief comparison charts. Also mentioned are green gold and white gold alloys and alloys with platinum and palladium. The chart for solders contains 38 recipes for making coloured gold solders. Another chart tells how to make solders for platinum and palladium alloys.

On 8 pages there are listings of various gold and silver coins from many countries with indication of fine content and weights. So one can see at once whether the Liechtenstein 10 francs that has been kicking around is better shoved in the rolling mill or re-alloyed with the help of chart 17.

Are you a good cook? Find out on page 52 how to mix your own testing acids. Yes, and the Moh's hardness scale is there too!



**BOOK REVIEW**
**HANDBUCH DES GOLD-SCHMIEDES BAND II**
**192 pages, $15.00, $2.00 postage**

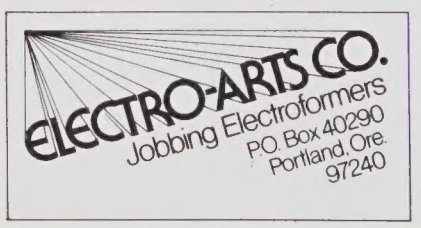
**by Hannelore Gabriel**

After customary introduction to precious metals, base metals and chemicals the book proceeds to testing and refining methods. Chapter III contains the basics of metallurgy with many illustrations, something that is too often missing in other books on metalsmithing.

Melting, alloying and recycling of scrap is given a lot of pages. I found many useful formulas for chemicals to be added for melting. For a craftsman who works alone it is good to learn about recycling scrap and filings and about mini-melts in the charcoal. Alloying math doesn't look very entertaining, but is useful if no charts are on hand.

With the knowledge of melting, casting is introduced next. The choices are many, casting in cuttle bone, sand stone, sand in a casting bottle, plaster and handheld centrifugal casting.

The last chapter is on soldering. Something I found beneficial for myself was an illustration on a variety of tricky tyings with binding wire.





**BOOK REVIEW**
**HANDBUCH DES GOLD-SCHMIEDES BAND III**
**373 pages with illustrations, $21.00, $2.00 postage**

**by Hannelore Gabriel**

The three books "Handbuch des Goldschmiedes" are celebrating their 50th anniversary this year. Originally it was one volume, but since its revision has branched out into 3 volumes.

Volume III is the practical part on how to make different jewelry projects and gives detailed descriptions on the construction of specific pieces of jewelry and mechanisms.

The chapters are: construction of gem jewelry, link and pin movements, construction with platinum with white gold bottom, construction of ear jewelry, construction of stiff bracelets, construction with platinum with gold, construction in gold, filigree jewelry, construction after nature models, hinges, construction of rings, construction of pins, making of chains and link bracelets, construction of clasps, making of wedding rings, wire technique, granulation, stone setting, engraving, repousse and chasing electroplating, polishing, metal colouring, repairs, casting with wax models, making of steel tools.

A lot of the techniques described in this book I haven't seen done in years, namely the years I have lived in the United States. The projects which are described are pieces of very traditional gem jewelry which these days here are made by machines. For this reason it might be especially interesting for the metalsmith of this country whose emphasis is more on expression to have instruction on how these movements, clasps and hinges are actually done by hand.

These books have already appeared on the German book list and can be ordered at 30% SNAG discount from: Hannelore Gabriel, SNAG Book Dept., Box 175, Madison, OH 44057.

For all orders of German books and museum catalogues, please add 10% to the cost since the dollar has dropped since the list was printed last year.

# OPPORTUNITIES

A position is now available for visiting instructor/visiting assistant professor in metalscrafts and jewelry. Starting date is Sept. 1979. An MFA or equivalent degree and college teaching experience are preferred. An expertise in basic metal processes with knowledge of several of the following: blacksmithing, plastic technology, electroforming, spinning, stone setting, and machining. Application requirements are: resume, 20 slides of recent work, 20 slides of student's work, a statement of educational philosophy, and three letters of reference. Send to: Dr. Robert H. Johnson, Dean, College of Fine and Applied Arts, Director, School for American Craftsmen, Rochester Institute of Technology, One Lomb Memorial Drive, Rochester, NY 14623.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## BUILDING ARTS

This is a new funding category developed in response to growing activity in the visual arts field. It recognizes broadening aesthetic concern among visual artists for site and structure. It is designed to promote the integration of the arts in the construction of permanent buildings and their components. Grants in this category encourage craftsmen and artists or pursue new designs and experiment with materials, and techniques for building construction. These grants are awarded for research and planning, not for the actual construction of buildings.

I. Research grants enable craftsmen and artists to develop innovative uses of industrial materials and technology in the design of building components such as hardware, lighting fixtures, bathroom fixtures, tiles, windows, wall and floor surfaces. Projects also may outline new approaches to carpentry, masonry, laminating, sandblasting, pouring concrete, and other methods of building construction.

II. Planning grants enable craftsmen and artists to plan and design buildings and sites. Grantees may collaborate with architects, builders, or industry on specific building projects. Project examples include, but are not limited to, designs for:

—One of a kind hand-made houses
—Building components or architectural embellishments
—Ecologically provident shelters
—Structures that may have no use other than to enrich the landscape with fine forms. Such structures include towers, gazebos, pavillions, caves, columns, pedestals, pools, fountains, waterfalls, parks, plant forms, paved surfaces, fences, and walls.
—Landscapes
—Restorations that require the use of historical tools and techniques.
—New buildings constructed with traditional techniques which preserve for our country crafts important in American history. Examples of such crafts include: adobe construction, stone-fitting and carving, timber joinery, blacksmith work, plaster work, cast metals, and building of log cabins, igloos and teepees. Floating and arboreal dwellings may also be included.

ELIGIBILITY—All visual artists.

GRANT AMOUNT—Research grants up to $5,000. Planning grants up to $5,000. Grants in this category do not require matching funds.

DEADLINE AND ANNOUNCEMENT DATES—Applications must be postmarked no later than Jan. 2, 1980. Applicants should not anticipate notification of awards or rejections before June 1980. Projects should not be scheduled to begin before July 1980 and should be carried out during the succeeding 12 months.

APPLICATION PROCEDURE—
For application and instructions write: Grants Office, Building Arts, Mail Stop 500, National Endowment for the Arts, 2401 E. St., N.W., Washington, DC 20506.

Please include with your application: 10 slides or other documentation of your recent work; an outline or description of your proposal; a list of anticipated expenses.

A project budget should include the costs for producing a visual record which will be filed with the Endowment upon completion of the proposed work. This record may be presented in its most useful form—slides, photographs, copies of drawings, films as well as written information. The intent is to preserve and make available through the library of the Arts Endowment a permanent record as a resource to the public.

## EXHIBITION OPPORTUNITIES

Slides Due: Sept. 8; Oct. 27-Nov. 25, "Marietta College Crafts National '79, 8th Annual Craft and Sculpture Exhibition," $5,000 in prize money: $1,000 Award of Distinction, $2,500 Judges Awards and $1,500 Purchase Award. Maximum 3 pieces; $10 entry fee. For a prospectus, write: MCCN '79, Arthur Howard Winer, Director, Marietta College, Marietta, OH 45750.

Sugarloaf's '1979 Shows: for detailed information on these, send full size SASE to: Ms. Deann Verdier, Director, Sugarloaf Mountain Works, Inc., P.O. Box 319, Poolesville, MD 20837:

1. Oct. 12-14, Timonium, MD, "3rd Annual MD Crafts Festival" at MD State Fairgrounds; space fees $100.
2. Nov.1 6-18, Gaithersburg, MD, "4th Annual Autumn Crafts Festival" at the Montgomery Co. Fairgrounds; space fees $100.
3. Dec. 7-9, Gaithersburg, MD, "2nd Annual Winter Crafts Festival" at Montgomery Co. Fairgrounds; space fees $100.

Deadline Date: July 13-14; Aug. 5-30, "Miniatures," open to all residents of MO and IL living within 170 miles of St. Louis; entry fee $10 for 103 entries. Write: Miniatures, Craft Alliance, 6640 Delmar Blvd., University, MO 63130.

Westfair announces that the "4th Annual Old-Time Country Music Contest and Pioneer Exposition" will take place in Council Bluffs, IA over Labor Day weekend, 1979 (Aug. 31-Sept. 2). Prize money totals up to well over $7,000 in cash money, recording studio time, certificates & other valuable gifts. For more information, contact: Bob Everhart, Director, 106 Navajo Council Bluffs, IA 51501.

Feb. 2-Mar. 15, 1980, "It's About Time," a national competition and exhibition of handmade one-of-a-kind clocks, clock movements and time-related craft objects to be held at the Craft Center Gallery. Juried by slides; for a free prospectus, write: It's About Time, Worcester Craft Center, 25 Sagamore Rd., Worcester, MA 01605.

Creative Fairs presents the following shows:

1. July 28-Sept. 3—"2nd NY Renaissance Festival of the Arts," Sterling Forest Gardens, Tuxedo, NY.
2. Nov. 16-18—"5th Annual Harvest Crafts Festival," Naussau Coliseum, Uniondale, LI, NY.
3. Nov. 25—"Super Crafts Sunday," 111 Meadowlands Complex, East Rutherford, NJ.
4. Nov. 30 & Dec. 1-2—"NY Contemporary Craft Exposition," Park Ave. Armory, NYC, NY.

(These shows are juried by slides. For more information, write: Creative Faires, Ltd., P.O. Box 1688, Westhampton Beach, NY 11978.)

Helen Drutt is planning a major invitational metal exhibition in 1981. Work is presently being reviewed and material can be forwarded to: Helen Drutt, Director of Moore College of Art Gallery, 20th & Race Sts., Philadelphia, PA 19103.

A jewelry design competition sponsored by the Jewelry Manufacturers Association of the Southwest, a non-profit organization, is seeking all qualified entrants. This is the Second Annual Regional Competition stressing design innovation and production values.

The competition will be divided into three categories: Gold Jewelry, Silver Jewelry, and Miscellaneous Jewelry/Jewelry Related Items. It will be a juried show with substantial cash awards. The showing of juried pieces will be held in Albuquerque, NM, in the late summer. For further information, please write: JMAS Design Competition, P.O. Box 40013, Albuquerque, NM 87106.

Deadline Date: Oct. 15, 1979, Feb. 1-March 14, 1980—"It's About Time," open to all artists and craftspeople who are not now full-time students. For more information, write: Craft Center, 25 Sagamore Rd., Worcester, MA 01605.

Deadline Date: Oct. 15, 1979, Nov. 16-18, 1979—The Fourth International Craft Film Festival, all 16mm films dealing with any aspect of traditional or contemporary crafts (with the exception of "How-To" films) are eligible for competition in the festival. "Crafts" here are defined as anything hand-made. For more information and entry blanks, contact: International Craft Film Festival, New York State Craftsmen, Inc., 37 W. 53rd St., New York, NY 10019, 212/586-0026.

Deadline Date: Oct. 15, 1979, "Young Americans: Metal," a national competition sponsored by the American Crafts Council for young craftspeople between the ages of 18-30, working in metal and enamel. The works must be original and executed by the entrant in the past two years. For more information and application, write: Young Americans, Metal, American Craft Museum, 44 W. 53rd St., N.Y., NY 10019.


YOUNG AMERICANS / **Metal**

A National Competition Sponsored by American Craft Council

All craftspeople who have permanent residence in the United States, 18 to 30 years of age (born between January 1, 1949 and December 31, 1961) are eligible.

Work executed in metal using traditional and/or experimental techniques including body adornment and functional and decorative objects. Eligible are traditional forging, fabrication, casting and enameling.

**Deadline—October 15, 1979**

For entry form write to:
American Craft Museum
44 West 53rd Street
New York NY 10019

# UPCOMING EVENTS

## CONFERENCES

Oct. 10-13, American Crafts Council Southeast Conference, held by the Southeast Regional Assembly of the American Crafts Council at the Arrowmount School of Arts & Crafts in Gatlinburg, TN. For brochure, write: ACC-SE Conference, Arrowmount School of Arts & Crafts, Box 567, Gatlinburg, TN 37738.

June 24-26, "Raising Money for the Arts," to be held in NYC. For further information, write: ACA Conference, Dept., 570 Seventh Ave., N.Y., NY 10018, or call 212/354-6655.

Nov. 16-18, The Fourth International Craft Film Festival, to be held at the Fifth Avenue Cinema in NYC in cooperation with the New School for Social Research. The festival is being sponsored by New York State Craftsmen, Inc. For more information, write them at: 37 W. 53rd St., N.Y., NY 10019, 212/586-0026.

The Knifemakers Guild is sponsoring their 10th Annual Show from July 27-30, to be held at the Crown Center Hotel in Kansas City, MO. Reservations must be received by July 3. For more information, write: Buster Warenski, P.O. Box 214, Richfield, UT 84701.


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## EXHIBITIONS

State University Park, PA, The Central PA Festival of the Arts 13th Annual Juried Crafts Exhibition, July 8-Aug. 25, at the Museum of Art.

Philadelphia, PA, "The Third Annual Philadelphia Craft Show," Nov. 15-18, Memorial Hall, Fairmount Park.

London, Ontario, Second Annual London Christmas Craft Sale, Dec. 5-9, Progress Bldg. Western Fairgrounds.

Grand Junction, CO, "Objects '79," July 5-Aug. 5, to be held at the Western Colorado Center for the Arts.

Layton, NJ, The Gallery Peters Valley, presents the following exhibits: Faculty Show 1979—July 21-Aug. 18; Fine Forgery—Oct. 6-Nov. 7; Sacred & Ceremonial—Nov. 17-Dec. 24. For more information, contact: Susanne Turino, The Gallery, Peters Valley, Layton, NJ 07851.

Asheville, NC, "32nd Annual Guild Fairs," Summer Fair—July 10-14; Fall Fair—Oct. 17-20; both fairs will be held in the Asheville Civic Center.

Las Vegas, NV, "19th Annual Art Round-Up," June 3-July 5, to be held at the Las Vegas Art Museum.

Toronto, Canada, "The Treasures of Tutankhamun," Nov.-Dec., to be held at Art Gallery of Ontario, only Canadian showing of this exhibition.

Carmel Valley, CA, July 7-Aug. 5, Mitsuko Soellner; Oct. 5-Nov. 4, Paul Mergen & Brenda Mergen; Nov. 16-Dec. 30, Edward DeLarge at the Concepts Gallery.


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The Helen Drutt Gallery, Spruce St., Philadelphia, PA, is presenting these one-person exhibits: Rudolf Staffel—June; Fall 1979 Shows Rise Rice, Bruce Metcalf, Albert Paley, George Timock, Wendy Ramshaw, David Watkins.

NYC, NY, International Craft Show, June 14-17, to be held at the New York Coliseum. For further information, contact: NY State Craftsmen, Inc., 27 W. 53rd St., N.Y., NY 10019.

Rhinebeck, NY, "Northeast Craft Fair," June 19-20 (buyers), June 22-24 (general public). Dutchess Co. Fairgrounds.

San Francisco, CA, "Pacific States Craft Fair," Aug. 2 (buyers), Aug. 3-5 (general public). Ft. Mason facilities.

Morristown, NJ, "Morristown Craftmarket," Oct. 5-7.

April 26-June 17, Silver in American Life, Pittsburgh, PA Museum of Art, Carnegie Institute. Also scheduled for Everson Museum of Art in Syracuse, NY—July 29-Sept. 30; High Museum of Art, Atlanta, GA—Nov. 3-Dec. 31; Amon Carter Museum, Ft. Worth, TX—Feb. 8-Apr. 13, 1980; Milwaukee Art Center, Milwaukee, WI—May 16-June 20, 1980; Virginia Museum, Richmond, VA—Sept. 19-Oct. 19, 1980; St. Louis Art Museum—Dec. 6, 1980-Feb. 1, 1981; Los Angeles Museum of Art—Mar. 5-May 10, 1981; Cleveland Museum of Art—June 24-Aug. 16, 1981; Denver Art Museum—Sept. 23-Nov. 15, 1981; Fine Arts Museum of San Francisco, M.H. deYoung Memorial Museum—Dec. 19, 1981-Feb. 14, 1982; and Detroit Institute of Arts—Mar. 24-May 16, 1982.

Willoughby, OH, Outdoor Arts Festival, July 20-23, 38660 Mentor Ave.

Madison, IN, Tenth Annual Chautauqua of the Arts, Sept. 29-30. For more information, write to: Mrs. Diane McDonough, 1119 W. Main St., Madison, IN 47250.

New York City, NY, "Statements in Sterling '79," May 31-June 19, to be held in the lobby of Lever House, Park Avenue at 53rd.

Asheville, NC, Southern Highland Handicraft Guild Fair, July 10-14 & Oct. 17-20, to be held at the Civic Center.

Rochester, NY, "Marriage Treasures II, Wedding and Engagement Rings," May 5-June 29, at the Gallery of Contemporary Metalsmiths.

Bristol, England, Barton G. Daniels, a major exhibit of his plastic & metal Jewelry, July & Aug., at the Arnolfine Gallery.

Windsor, Ontario, Second Annual Windsor Christmas Craft Sale, Nov. 23-26, at the Cleary Auditorium.

Washington, DC, to be held at the Renwick Gallery at the Smithsonian Institute, Olaf Skoogfors, 20th Century Goldsmiths, April 6-Aug. 19, organized by the Philadelphia College of Art.


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## WORKSHOPS

Brookfield Craft Center presents the following summer classes:

1. Further Explorations for Enamelists, July 9-13, Judith Daner, $72.
2. Fundamentals of Jewelry, July 16-20, Pat Flynn, $72.
3. Casting/Jewelry, July 23-27, Pat Flynn, $72.
4. Copper Forms, Aug. 6-10, Elliott Pujol, $72.
5. Hollow Core Jewelry and Container Construction, Aug. 13-17, John Cogswell, $72.
6. Jewelry-Wire Construction, Aug. 20-24, Mary Lee Hu, $72.

For more information, write: Brookfield Craft Center, P.O. Box 122, Brookfield, CT 06804, or call 203/775-4526.

Parsons School of Design presents the following course: Introduction to Metals, July 5-Aug. 1, $300, 4 credits. For more information, write: Parsons School of Design, 66 Fifth Ave., N.Y., NY 10011.

Summervail Workshop 1979 presents the following classes:

1. June 18-22, Elliott Pujol, Metals Studio Construction.
2. June 25-July 13, Elliott Pujol, Metalsmithing, with Emphasis on Sinking and Raising.
3. July 9-12, Jim Wallace, Blacksmithing with Emphasis on Damascus.
4. July 13-15, The Fifth National Rocky Mountain Metalsmithing Symposium, coordinated by Lan Coulter.
5. July 16-20, Fred Fenster, Pewter.
6. July 16-Aug. 3, Richard Prillaman, Metalsmithing, with Emphasis on Chasing and Repousse.

All classes (except the metals symposium) are 3 credits offered through Colorado Mountain College. Tuition is $18 (district residents), $39 (in-state residents), $135 (out-of-state), plus additional $20 registration fee. For more information, write: Summervail Workshop, Box 1114, Vail, CO, 81657, or call 303/476-4040, or 303/827-5703.

Electro-Coloration by James Ward, July 16-20, Longwood College; 3 credit hours (undergraduate or graduate). Cost approximately $155, including room, board & tuition. Write: Mark Baldridge, Art Dept., Longwood College, Farmville, VA 23901.

Peters Valley presents the following workshops: June 25-29, Bob Natalini/Van LeBus; July 5-7, Jamie Bennett; July 9-13, Merily Tompkins; July 16-27, Merci Zelmanoff; Aug. 2-4, Heikki Seppa; Aug. 6-17, Fred Woell; Aug. 20-30, Chuck Evans. For further information, contact: Peters Valley, Layton, NJ 07851.

The 1000 Islands Museum Craft School presents the following workshops: Enameling—Dorothea Lagrange-Lee; Jewelry—Emily Sohier. For further information, write: The 1000 Islands Museum Craft School, 314 John St., Clayton, NY 13618.

The Oregon School of Arts & Crafts presents several summer workshops in metals: "Repousse & Chasing"—Nilda Getty, July 24-28; "Rendering Techniques & Granulation of Metals"—William Neumann, July 30-Aug. 4; "Experimental Techniques of Enameling"—Martha Banyas, Aug. 14-24. For more information, write: Paulette Wittwer, 616 NW 18th St., Portland, OR 97209.

The Penland School of Crafts presents the following workshops: JEWELRY: Kelly Morris—June 18-29; Marilyn Davidson—July 2-20; Mary Ann Scherr—July 23-Aug. 10; Jim Malenda—Aug. 13-31; Hannelore Gabriel—Sept. 3-12; ENAMELING: Karen Blockman—June 4-15; Mel Someroski—June 18-29; Martha Banyas—July 2-20; Steven Zeitlin—July 23-Aug. 10; Helen Hosking—Aug. 13-31; Bill Helwig—Sept. 3-21; LAPIDARY: George Parker—June 18-29; Roy Clifton—July 2-20. Some visiting scholars will be Tom Gentille, Jewelry; William Brown, Jr. and John Wallace, Blacksmithing; For further information, write: Penland School, Penland, NC 28765.

Jamie Bennett will be doing a workshop in enameling at Northern Michigan U., Marquette, MI, June 25-July 6. Participating students can receive 2 semester hours credit for the session (graduate or undergraduate). For further information, write: Natalie Paul, Dept. of Art & Design, Northern Michigan U., Marquette, MI 49855.

The Brookfield Craft Center presents the following spring and summer classes:

1. Special Summer Workshop—Richart Coble and Susan Corey; to give students the opportunity to explore new approaches to their craft; June 25-July 6.
2. Basic Jewelry—Pat Flynn, July 16-20.
3. Casting—Pat Flynn, July 23-27.
4. Experimental Enameling—Judith Daner, July 9-13.
5. Hollow Core Jewelry & Containers—John Cogswell, Aug. 13-17.
6. Wire Constructions/Fiber Techniques/Jewelry—Mary Lee Hu, Aug. 20-24.

(For further information on these write to: The Brookfield Craft Center, Inc., P.O. Box 122, Brookfield, CT 06804.)

July 23-Aug. 24, Summer Workshop in Metalsmithing. Guest workshop leaders: David La Plantz—Fabrication with cold joins and wire as a semi-solid element; Douglas Steakley—Holloware; Richard Gompf—Sandcasting; Alan Revere—Metalurgy and Granulation; Florence Resnikoff—Electroforming, Metal, Ceramic and Glass. This will be held at the Shaklee Bldg., CA College of Arts & Crafts, Broadway at College, Oakland, CA 94618.

GIA is offering a travel seminar to gem centers in the Far East, Sept. 15-30. Brochures on the 1979 seminars are available from: GIA, P.O. Box 2110, Santa Monica, CA 90406.

Gold! Metallurgy, design, fabrication, gold country trip; July 2-20; Revere Academy of Goldsmithing, 760 Market St., Suite 937, San Francisco, CA 94102.

Stone Setting. Bezels prongs, pave, etc.; June 19-Aug. 7. Jewelry Design and Rendering; Creativity; Rendering, Presentation; June 21-Aug. 9. For more information, write: Alan Revere, CA College of Arts & Crafts Extension Div., 5212 Broadway, Oakland, CA 94618.

The Arrowmont School of Arts and Crafts is offering the following courses:

1. June 11-22—Metal Design
2. June 25-29—Enameling, Kenneth Bates; Metal Design, Thomas Markusen
3. July 2-13—Metal Design, Lynda Watson
4. July 16-20—CIDH Metal Design, Elliot Pujol; CIDH Metal Design, Jim Wallace
5. July 23-27—Metal Design, Deborah Aguado
6. July 30-Aug. 10—Metal Design, Mary Lee Hu

(For more information, write: Arrowmont School of Arts & Crafts, P.O. Box 567, Gatlinburg, TN 33738.)

July 30-Aug. 18—Jewelry; 3-week professional summer workshop presented by Bruno Martinazzi, to be held in Ansedonia, Italy. For further information, write: Ms. Paula Freeman, c/o Studio Prof. Martinazzi, Lungo Po Diaz 2, Torino 10123, Italy.

# TECHNICAL INFORMATION

## SILVER INSTITUTE PUBLISHES TECHNICAL SILVER SUMMARIES

The Silver Institute studies more than 275 reports each month of new research done throughout the world on silver and silver products. Four times a year, the Silver Institute presents about 70 of these reports in a publication called New Silver Technology. These presentations are not simply abstract references, but each item is intended to be a readable summary of the new technology which has been developed. The names of those who did the work and the full addresses, showing where the work was done or reported, are also provided, as well as the patent designations, or the issue and page designations for the technical publications carrying the texts of the reports.

Goldsmiths Journal has selected four of these summaries and is reprinting them with permission of the Silver Institute, Suite 1138, 1001 Connecticut Ave., Washington, DC 20036. We felt these were the most interesting, wide-ranging, and potentially applicable. Subscription to the New Silver Technology is available from the Silver Institute at $25 per year. Members finding these reports particularly interesting should subscribe directly to the Institute to insure a complete and uninterrupted supply of summaries.

### ADHESIVE BONDING

A minute amount of silver is used to give much more durable recapped automobile tires. The silver and a monomer or prepolymer are contained in a novel styrene butadiene rubber adhesive. This adhesive forms a strong peel-resistant bond between a new tread band and an old tire casing.

Conventionally it has been necessary to roughen the surface of the old tire to assure adequate adhesion between the tread band and the tire. However, the fine rubber particles formed during this roughening process are released into the air and cause an air pollution problem.

Old tread from the tire can now simply be cut off the tire with a knife. Although the resulting cut surface is relatively smooth, the silver in the adhesive causes a stronger bond to be formed than was previously possible even with a roughened surface.

Silver initiates grafting of the monomer in the adhesive, to the rubber in both the new tread and the old tire. Ions of silver are capable of interacting with labile hyrogen atoms of butadiene and other dienes found in rubber. The free radicals produced by the activation of the hydrogen atoms begin an autocatalytic graft polymerization of the rubber with the monomer of the adhesive.

This remarkable effect of silver in the adhesive is achieved with only 10 to 100 parts per million of silver perchlorate ($AgC10_4$), added as a 0.1% solution in isopropyl alcohol. The inclusion of a peroxide such as cumyl peroxide, keeps the silver in the adhesive in the effective ionic condition, rather than allowing it to precipitate as elemental silver.

Recapped tires prepared with the novel adhesive are highly resistant to peeling. Even when the new tread is put on the smooth surface of a knife-cut tire casing, a force of more than 80 pounds per square inch (552 pascals) is required to cause peeling. The peel strength is considerably lower for recaps prepared with a conventional industrial adhesive which does not contain silver and a monomer or prepolymer: when the conventional adhesive is used on a smoothly cut tire peeling occurs with a force of only 50 pounds per square inch (345 pascals) and when the tire surface is roughened before application of the conventional adhesive, peeling still occurs with a force of only 70 pounds per square inch (483 pascals). (In English)

Carl Horowitz, Michael Dichter, and Navinchandra Bhogilal Shah, Polymer Research Corp. of America, 2186 Mill Ave., Brooklyn, NY 11234, *United States Patent* 4,051, 090, Sept. 27, 1977.

### SURFACE TREATMENT OF SILVER PRODUCT

A solution containing a gold compound can be used to deposit an attractive glossy black finish on silver items such as jewelry. A treatment solution is prepared by dissolving 30 grams of tetrachloroauric acid ($HAuC1_4$) in 20 milliliters of an ethyl alcohol ($C_2H_5OH$) solution saturated with iodine ($I_2$). This is then diluted 250-fold by the addition of 5 liters of ethyl alcohol.

Cast silver is dipped into the diluted treating solution for 30 seconds. After washing, the treated silver object is exposed for one hour to ultraviolet radiation, resulting in a black coating.

If desired, the resulting black layer on the silver may be polished. A useful polish paste for this purpose is a mixture of sodium sulfate ($Na_2SO_4.10H_20$) and sodium bicarbonate ($NaHC0_3$). (In Japanese)

Toshio Kurotani and Yogo Shimada, Kurotani Bijutsu Co., Ltd., 7-10, Nagonoe, Shinminato-Shi, Toyama Prefecture, Japan, *Japanese Kokai Patent*, 77 32,833, Mar. 12, 1977.

### HAIR DYEING COMPOSITIONS CONTAINING SILVER SALTS

A new hair dressing has been developed for the gradual darkening of hair and for the maintenance of the desired color by periodic further applications.

It may be made in the form of a shampoo containing 45% sodium ammonium triethanolamine monoethanolamine alkyl sulfate, 2% of the diethanol amide of coconut fatty acid, 0.3% citric acid, and 51.8% water, with the active coloring ingredient being 0.9% silver acetate ($CH_3COOAg$). Small amounts of perfume and preservatives are included. Application is by a one-step shampoo application, with the color developing on exposure of the hair to light and to air.

The results with the composition are similar to those obtained with the widely sold preparations which contain lead acetate ($[CH_300]_2Pb$) as their active ingredient.

The silver is non-toxic. There is no discoloration of hands or fingernails if the composition is washed off within one or two minutes after coming in contact. As reported elsewhere, if such silver discolorations should occur, they may be removed by contact with low pH solutions of thiourea, such as Tarn-X. (In English and in German).

Baju Kattunilath Eipe and Barbara Anne Weir, Beecham Group Ltd., Beecham House, Great West Rd., Brentford, Middlesex, England, *German Patent* 2,714,753, Oct. 27, 1977.

### APPARATUS AND METHOD FOR SELECTIVE ELECTROPLATING OF METALS

A novel electroplating technique utilizes a spray to apply the silver plating solution. A variable diameter nozzle forms a jet spray. Electroplating is achieved by connecting the nozzle as an anode and connecting the surface to be plated as a cathode.

The silver is deposited over the desired area by swinging either the nozzle or the surface to be plated. Masking is not necessary, since the relative position of the jet and of the surface being plated determines the precise location where the silver will be deposited. The jet preferably strikes the surface to be plated at an angle of 90 degrees.

Much of the silver in a conventional electroplating bath remains in the bath and is lost to the plating operation when the conventional dipping techniques are used. It is found that the novel spray technique optimizes the use of the silver so that almost all of it is deposited on the parts to be plated. In addition to being used for silver electroplating, this new technique is very suitable for plating gold and alloys of silver and gold. (In German)

Manfred Dettke and Wolfgang Weishaupt, Schering A.-G., Mullerstrasse 170, 1000 Berlin 65, Federal Republic of Germany, *German Patent*, 2,551,988, May 26, 1977.

# PROPERTIES AND USES OF TITANIUM, ZIRCONIUM, HAFNIUM, NIOBIUM (COLUMBIUM), AND TANTALUM FOR THE ARTIST-METALSMITH

© 1979 by Joseph F. Hall

ACKNOWLEDGMENTS--Special thanks to Vic Massey of Teledyne Wah Chang Albany for helping me locate a great deal of obscure information about the metals, and thanks to Ramona Solberg and John Marshall of the University of Washington for their encouragement.

ABSTRACT

Titanium and other refractory metals have recently been attracting the interest of artist-metalsmiths. While their primary use has been in terms of "coloring" via controlled thickness, oxide layer production; consideration of their physical properties, formability, and safety-health characteristics have largely been ignored. It is the purpose of this paper to deal with these considerations in the hope of presenting a framework on which further artistic experimentation and research can grow.

INTRODUCTION

The metals in consideration are pure metals * i.e., chemical elements. They are not allomorphs or alloys of other more familiar metals. One common property of these metals is their very high melting point; this has lead to the locution "refractory metals" for the group. While the American Society for Metals defines a refractory metal as any metal with a melting point higher than that of iron, cobalt, or nickel (c. 2800 deg. F) this would lead to a definition that would describe approximately sixteen pure metals. For practical purposes though, it is usually taken to refer to the nine metals of groups IVB, VB, and VIB of the periodic table: titanium (Ti)**, zirconium (Zr), hafnium (Hf), vanadium (V), niobium (Nb)***, tantalum (Ta), chromium (Cr), molybdenum (Mo), and tungsten (W).

Unlike most metals used by artists these metals were not known to ancients. Their discovery as distinct metals/metallic elements dates from the late eighteenth to the early twentieth century. Most were first recognized only as oxides (or to use the archaism: "earths") because the technology to produce the pure metal, or metal regulus, did not exist until approximately the turn of this century (Fig. 1).

Some of the physical properties of the metals are shown in Figure 2. Common properties are their high melting points, similar chemical properties, formation of a relatively inert oxide layer when heated (or simply by the action of air on freshly cut metal), they are also pyrophoric in air when strongly heated. While their mechanical properties differ considerably, they all become brittle and hard when heated in air due to oxygen absorption*. Their primary applications are in the aerospace, nuclear, chemical, and electronic industries.

*Pure should be taken to mean commercially pure which is usually 99.0-99.5%. Scientific/chemical purity is usually considered to be 99.9% or higher.

**These are the internationally accepted chemical symbols/abbreviations for the metal/element.

***Also known as columbium (Cb), however niobium is preferred.

*Other gases may be absorbed e.g., hydrogen and nitrogen forming hydrides or nitrides respectively, similar mechanical changes will occur.

FIGURE 1

| METAL | DISCOVERY AS AN ELEMENT | FIRST PRODUCTION AS PURE METAL |
|---|---|---|
| Titanium | 1795 | 95% 1887, 99.9% 1910 |
| Zirconium | 1789 | 1914 |
| Hafnium | 1923 | 1923 |
| Niobium | 1801 | small quantity c. 1900, large 1929 |
| Tantalum | 1802 | c. 1903 |

The metals, with the exception of titanium, are scarce in the earth's crust**, but all are far more common than gold or silver (Fig. 3). Cost of the metals in the commercially pure state, as sheet, is as follows:

Titanium, $8-$10/pound av.
Zirconium, $15-$25/pound av.
Hafnium, $200-$350/pound av.
Niobium, $80-$100/pound av.
Tantalum, $80-$100/pound av.

These prices will vary with supplier, quantity, thickness of sheet, form of mill product, and degree of purity.

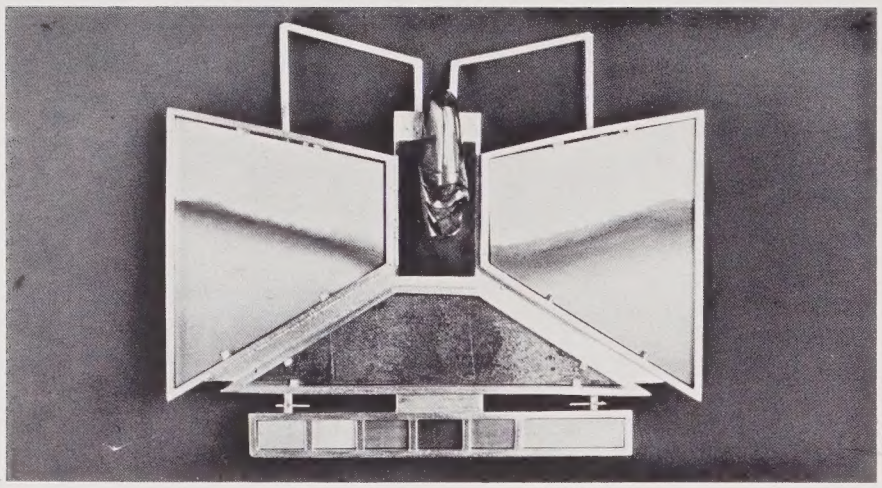
**Titanium is the tenth most abundant element in the earth's crust being more common than carbon or sulfur.

FIGURE 2

| Metal | Melting Point | Density | Color | Percent Elongation | Tensile Strength | Yield Strength | Hardness | Annealing Temperature |
|---|---|---|---|---|---|---|---|---|
| Silver-fine | 1761 F | 10.49 a | silver | 48-54% | 18,200 b | 7900 b | 27c | 572 F |
| Gold-fine | 1945 F | 19.32 a | gold | 45% | 18,500 b | Nil | 25c | 575 F |
| Titanium 99.2% | 3035 F | 4.51 a | lt. gray silver | 28% | 59,000 b | 40,000 b | 190 c | 1100-1350 F |
| 99.0% | " | " | " | 25% | 95,000 b | 80,000 b | — | " |
| Zirconium 99.5% | 3350 F | 6.49 a | " | 18% | 41,500 b | 25,000 b | 110-180 c | 1350-1450 F |
| 99.0% | " | " | " | 16% | 53,500 b | 31,000 b | — | " |
| Hafnium | 4046 F | 13,09 a | " | 24% | 55,000 b | 20,000 b | 190 c | 1450 F |
| Niobium | 4474 F | 8.6 a | bright silver | 30% | 30,000 b | 15,000 b | 80 c | 1450 F |
| Tantalum | 5425 F | 16.6 a | blue violet gray | 40% | 40,000 b | 19,000 b | 90 c | 2000 F |
| Stainless steel—18-8 | c.2500 F | c. 7.5 a | lt. gray silver | 30% | 75,000 b | 45,000 b | c. 160 | — |
| Aluminum 1100 series | 1190 F | 2.71 a | silver gray | 40% | 13,000 b | 5,000 b | 23 d | 650 F |
| Copper DHP | 1981 F | 8.94 a | copper | 45% | 32,000 b | 10,000 b | 40 e | 700-1200 F |

All figures are approximate and represent an average if a range was given; anisotropic properties have been neglected.

a—grams/cc
b—pounds/in$^2$
c—Vicker's or Diamond Point hardness
d—Brinell hardness 500kg
e—Rockwell "F" hardness



Joseph Hall, sterling, titanium and steel 3"x2"

PRODUCTION OF THE METALS

The production of these metals on a significant commercial scale did not begin, in most cases, until the last thirty years. This was not so much a limitation caused by technology but rather by lack of demand. Only with the advent of the aerospace and nuclear industries, and the recognition of their cost effectiveness by the chemical industry for handling corrosive substances did their production substantially increase.

Production of the metals from ores is quite complicated; with special problems arising in separating zirconium from hafnium, and niobium from tantalum. This is exacerbated by the fact that even though the metals are not exceptionally rare in nature their ore deposits are very widely distributed in low concentrations throughout the world. In brief, the production of the metals from ore is a three part process: the first step is the formation of a pure metal compound, the second step is the chemical reduction of this compound to the pure metal, and the third step is the consolidation of the metal by melting. This may be illustrated by a simplified account for the production of titanium:

Step 1: $TiO_2 \xrightarrow[C]{Cl} TiCl_4$ ; Formation of a reducible titanium compound from titanium dioxide ore.

Step 2: $TiCl_4 \xrightarrow{Mg} Ti + MgCl_2$;

Formation of titanium metal by chemical reduction of titanium tetrachloride by magnesium.

Step 3: Conversion of the titanium metal sponge to a titanium ingot by melting.

The process is more complex with the separation of hafnium from zirconium, or niobium from tantalum; in both cases more subtle chemical differences are used e.g., differences in solubility of analagous compounds, to achieve the separations.

An interesting aside here is the process used to melt the metals. Because of the extremely high melting points and reactivity with oxygen of the metals conventional melting techniques cannot be used. This problem is avoided by the two most commonly used melting processes: consumable electrode vacuum arc melting and electron-beam melting. In the first process an electrode composed of welded refractory metal sections is produced. The electrode along with a water cooled mold is then placed in a melting chamber. The chamber is then evacuated to a pressure of $10^{-2}$ mm of mercury. An arc is struck between the refractory metal electrode and the mold melting the tip of the electrode and maintaining a shallow pool of the molten metal in the mold. The metal electrode is lowered towards the pool in the mold as it is consumed and the mold filled. The arc is then stopped and the ingot allowed to cool before removal and milling. Ingot size may be one foot in diameter and six to eight feet long (Fig. 4). In electron-beam melting a welded or sintered bar of the metal is forced into the path of a high velocity electron beam (produced by an electron gun) which both melts the metal and maintains a shallow pool of the molten metal in a water cooled mold directly below the melting bar. The ingot is continuously lowered through the vacuum chamber as it is formed by the melting of the bar. The ingots may be one foot in diameter and up to ten feet long (Fig. 5).

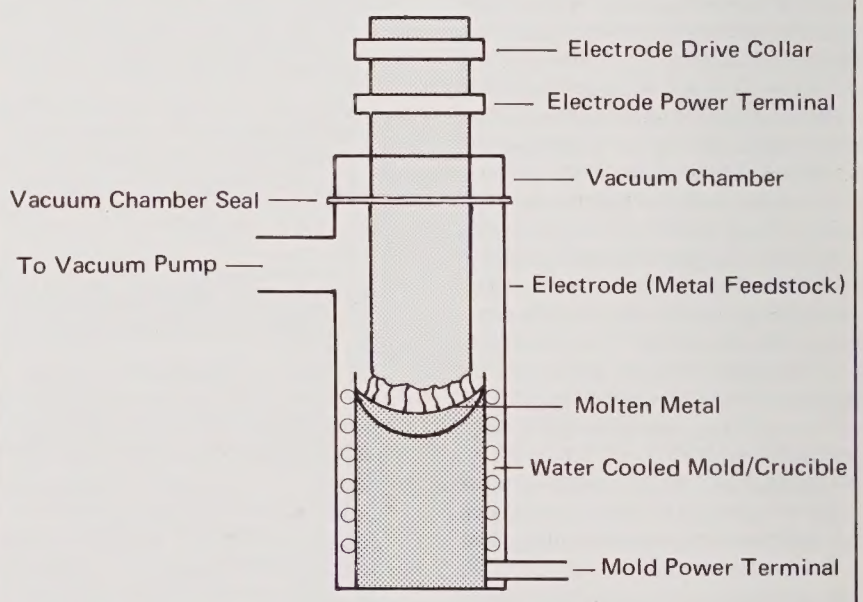
FIGURE 3

| METAL | PERCENT IN EARTH'S CRUST |
|---|---|
| Silver | $10^{-8}$% |
| Gold | $10^{-9}$% |
| Titanium | $6x10^{-1}$% |
| Zirconium | $4.5x10^{-4}$% |
| Hafnium | $9x10^{-6}$% |
| Niobium | $2x10^{-3}$% |
| Tantalum | $2.1x10^{-4}$% |
| Aluminum | 8% |

COLORING OF THE METALS— NATURE OF THE COLORS

The surface of these metals may be oxidized to produce brilliant colors which are permanent and reasonably durable. This has been, with justification, the major use of the metals by artists. It should be understood though that the colors do not derive from any inherent color of the oxide, but rather from an interaction of the colorless oxide film with light through a phenomenon known as interference (this is the same phenomenon that gives colors to soap and oil films). To understand these interference colors, some background in the physics of light is required. The contemporary paradigm of the nature of light states that it is composed of particles (photons) that exhibit wave-like characteristics (termed the "wave particle duality" of light), but for our purposes it is sufficient to simply consider it a wave. Being a wave it will have the characteristics of waves and undergo physical phenomena associated with waves e.g., it will have wave length and amplitude, undergo reflection, refraction, and interference (and other effects). Taking any one wave an oscillation is characteristic of its pictorial representation: one complete "S" shaped oscillation defines the wavelength (Fig. 6). Interference occurs when two light waves combine. If they combine when the waves are "in phase*" light is seen; if they combine "out of phase*" little or no light will be seen. Assuming that two waves of the same wavelength arrive at the surface of the oxide film, say one immediately after the other, one could be reflected from the top surface of the film and the other undergo defraction and be reflected up from the bottom surface of the film (the metal-metal oxide film interface). If uniting of the two waves then occurred to form a single ray** the two waves could be either in phase or out of phase — if they were 180 degrees out of phase they would nullify each other (because of destructive interference) and the eye

FIGURE 4
VACUUM ARC MELTER




*If the crests and troughs of the waves coincide they would be termed in phase; if they did not they would be out of phase up to a maximum where one's crest is at the other's trough, they are the termed 180 degrees out of phase.

**A ray is composed of many individual waves traveling in exactly the same direction on an imaginary line through space.

would not perceive any light reflecting from the surface and it would appear black (assuming that it was the only light incident to the metal surface). White light is obviously not monochromatic ie., composed of only one wavelength, instead it is composed of the red, green, and blue wavelengths/band-widths. If only one of these colors is destructively interfered with, the reflected color would be the combined result of the other two according to additive color theory e.g., if only green underwent destructive interference the resultant color would be blue+red forming magenta/purple. The thickness of the oxide film determines what colors undergo destructive interference (other factors also play a role: angle of incidence of the light; index of refraction of the oxide film, color of the parent metal, and others; however, these are usually out of the artist's control after selecting the metal). *Thus control of the oxide layer thickness will dictate its color.*

FIGURE 6
WAVE PROPERTIES

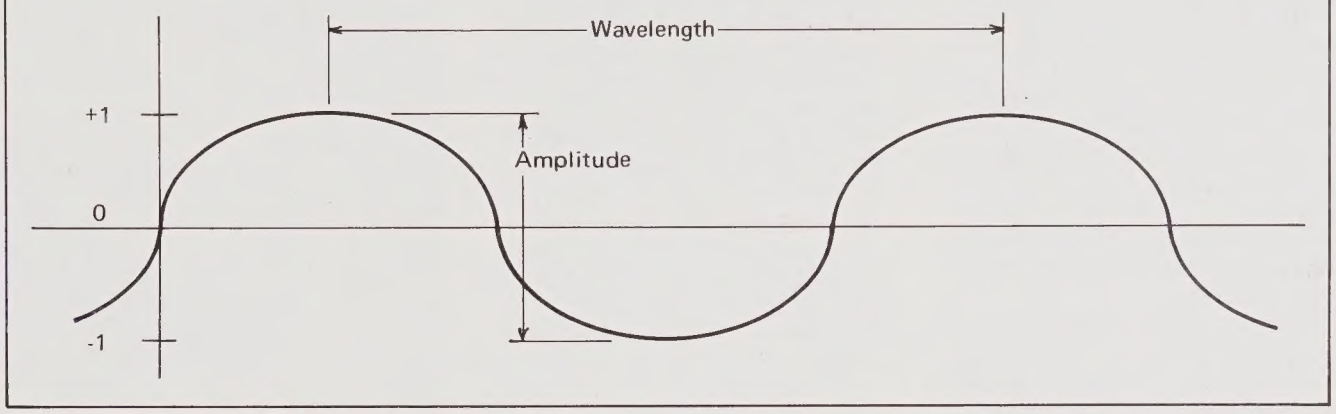
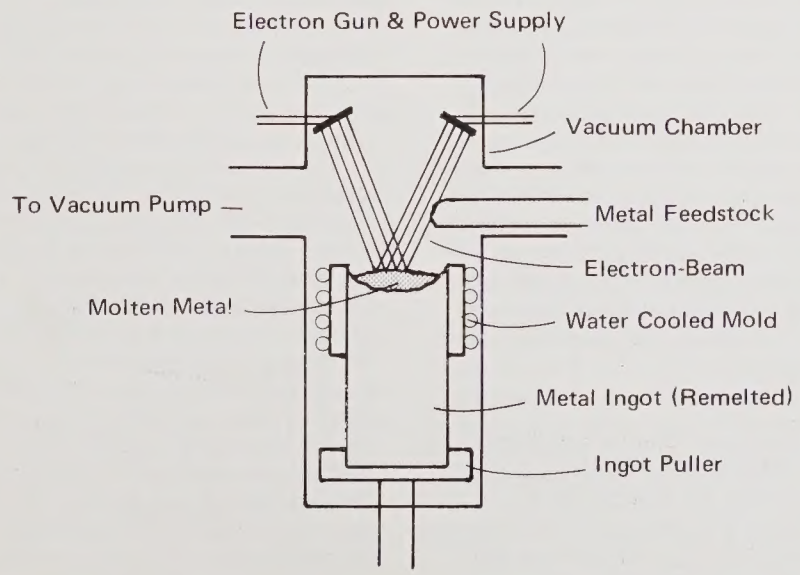



FIGURE 5
ELECTRON BEAM MELTER




COLORING OF THE METALS-- PRODUCTION OF THE OXIDE FILMS

All of the metals react with oxygen to produce oxide films/layers (Fig. 7). The two principle ways of producing the films are by direct heating of the metal, and by anodizing. In the heating method the oxide layer is produced by simply playing a torch over the surface of the metal. Anodizing is the process of oxidizing the metal electrolytically, a process similar to plating*. Both methods aim at producing a film of controlled thickness. It should be understood that the colors cannot be mixed like paints; the colors are limited to a standard color series (Fig. 8), by the laws of physics. Variations in intensity of the color can be achieved by varying the finish of the metal surface before oxidizing (see finishing).

HEATING METHOD

Heating is the easier and the more limiting of the two techniques. The first limitation is that niobium and tantalum do not form oxide films capable of producing colors by this method, instead they form a gray or black oxide layer. The second limitation is that of control of the color and its precise placement on the metal. These problems arise because of the difficulty of stopping the heating when the desired color is achieved, and of conduction of heat to undesired areas on the piece.

Procedure for heat coloring: (1) select the surface finish for the parent metal (see finishing); (2) thoroughly clean the metal surface. Wash in a hot ammonia-detergent-water solution. Rinse in water. Degrease with methylethyl keton, denatured alcohol, acetone, etc. (denatured alcohol is probably the safest); (3) place the metal on a clean non-heat-conducting material e.g., fire bricks or charcoal, and heat. Colors will follow the standard color series as the heating proceeds varying with oxide layer thickness: a thicker oxide film being produced where the heating was strongest.

The type of air-gas or oxygen-gas torch used seems to make little difference. An oxygen-gas system with a very small hot flame can more easily produce localized colors; on the other hand, it is more difficult to get broad areas of even colors with this kind of torch than a cooler more broad flamed gas-air system. A kiln, with a strongly oxidizing environment, can be used, but observing the color changes on the metal is more difficult.

Of the metals amenable to flame coloring, titanium seems to produce the most pleasing range of colors for all surface finishes. Zirconium and hafnium produce brilliant colors when polished, especially chemically polished, but appear rather desaturated and dull with most other finishes.

ANODIZING METHOD

As mentioned earlier, anodization is electrolytic oxidation. It is a process similar to electroplating except nothing is plated; instead water is disassociated into hydrogen (at the cathode) and oxygen (at the anode). The oxygen oxidizes the material at the anode. Briefly, the work-piece is the anode surrounded or immersed in

*A common example is the anodizing of aluminum. However, in aluminum the colors arise from dyes embedded in the oxide layer during the process, not from interference effects.

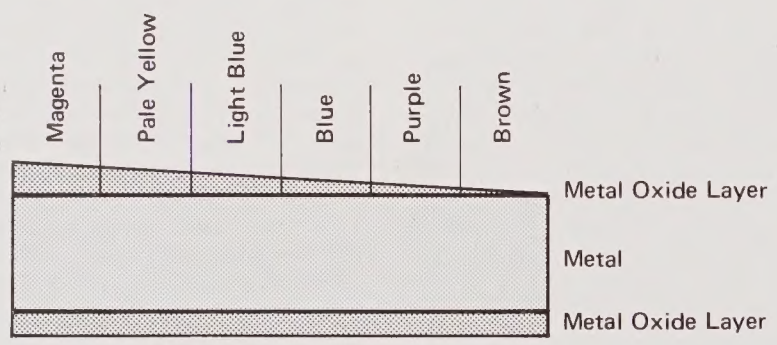
an electrolyte with an inert metal used as the cathode. Current is supplied from a power source that can produce a wide range of variable voltage. At any voltage there is a specific color that will form because voltage is proportional to oxide layer thickness (Fig. 9). All of the metals can be anodized with varying results. The anodizing process gives the artist far greater control in selection and placement of the desired colors on the metals (the use of selective masking further enhances control [see masking/resists] ).

The equipment needed for anodizing consists of an AC* or DC power source capable of producing variable voltages from 0-120 or 0-140 volts, an electrolyte, and depending on the technique, either a container for the bath or an applicator for the electrolyte. AC power sources are recommended because they are both easy to build and fairly inexpensive. From my limited experience with DC sources , I can see no difference in the quality of the colors. Conventional electroplaters are generally not suitable because their maximum voltage output is usually only 15 volts.

My AC anodizer is shown in Fig. 10a; it is 9''x5''x6'', weighs 7 pounds, and cost approximately $45.00 to build. Fig. 10b shows the inside of the unit with major components labeled. Fig. 11a is a schematic wiring of the circuitry. Fig. 11b is a component wiring diagram describing the unit more qualitatively. The heart of the unit is a variable autotransformer with 120 or 140 volts output at 5 amps (the maximum output is dependent on one's choice in connecting the transformer). A ''plug-in'' voltmeter was added for convenience, but one was really not needed, because the transformer comes with a dial indicating percent output (this could be calibrated for specific colors rather than relying on a voltmeter e.g., 15% output could be a deep blue).

FIGURE 7
OXIDE LAYER ON METAL

(colors vary with thickness)




Not To Scale

| FIGURE 8 | STANDARD COLOR SERIES<br>COLOR OF OXIDE FILMS | FIGURE 9 |
|---|---|---|
| HEATING METHOD<br>FIRST-THINNEST | | ANODIZING METHOD<br>FIRST-THINNEST |
| AMT. OF HEAT | | VOLTAGE (AC) |
| Least Heat | Very Light Yellow | 5 |
| | Yellow Brown | 10 |
| | Purple | 15 |
| | Blue (Dark) | 20 |
| | Blue (Light) | 25-30 |
| | Pale Green-Gray Blue | 35-40 |
| | Pale Yellow and Pale Green Blue | 40-45 |
| | Yellow | 45 |
| | Yellow and Pale Rose | 50 |
| | Magenta | 55 |
| | Deep Green Blue with Magenta | 60 |
| | Deep Blue Green with Magenta | 65 |
| | Magenta and Gold | 70 |
| | Magenta and Green | 75 |
| | Blue Greens with Magenta | 80-90 |
| | Blue Greens | 90-100 |
| | Spotty Green Gray | 105 |
| Most Heat | Grays | 115+ |

These colors are for titanium with an ammonium sulfate electrolyte; colors on other metals will be similar with certain ranges more brilliant on some metals. Colors are subjective and not from analytical tests of reflectance.

ELECTROLYTES-CATHODES

The electrolyte I now use is the one suggested by James Brent Ward*, it is a 10%, by weight, ammonium sulfate and water solution. A complex electrolyte used by Teledyne Wah Chang Corporation works very well on zirconium and hafnium**. Other electrolytes are also acceptable e.g., copper sulfate-water and sodium carbonate-water, but the ammonium sulfate-water electrolyte is recommended. My cathode is usually a piece of scrap titanium, but certain stainless steels are also satisfactory. The electrolyte keeps well in a stoppered glass or plastic bottle. It does not require maintenance as plating solutions do, and can simply be discarded when it becomes contaminated or exhausted (a solution is exhausted when the colors are no longer vivid or they require higher voltages to achieve the same color). The greatest cause of contamination comes from the cathode dissolving (titanium cathodes do not dissolve).

Procedure for anodizing: (1) select surface finish for the parent metal (see finishing); (2) clean as in step 2 of heat coloring; (3) *make sure that the power is off on the anodizer.* Connect a scrap piece of titanium, as the cathode, to one of the leads of the AC anodizer — if DC is used it must be connected to the cathode lead. Connect the piece to be anodized to the other lead; (4) suspend both pieces in the electrolyte making sure they do not touch each other (shorting would occur if they did touch); (5) the anodizer is turned on and the voltage increased until the desired color is obtained (Fig. 9). If parts of

*There is no true anode or cathode in an AC system; the terminals alternate between being positive and negative. Oxidation will still occur providing it is not reduced when it becomes the cathode. This is a simplified explanation. The terms anode and cathode will be used for both AC and DC systems, but they strictly apply only to the DC system.

*James Brent Ward, *Craft Horizons*, "Titanium: Metal of Many Colors", pp 20 and 21, August 1977.

**Percent by volume: granular citric acid 1.0%, Conc. Phosphoric acid 4.0% Lactic acid 8.0%, Glycerol 15%, Water 26.5%, Methanol 45.5%.

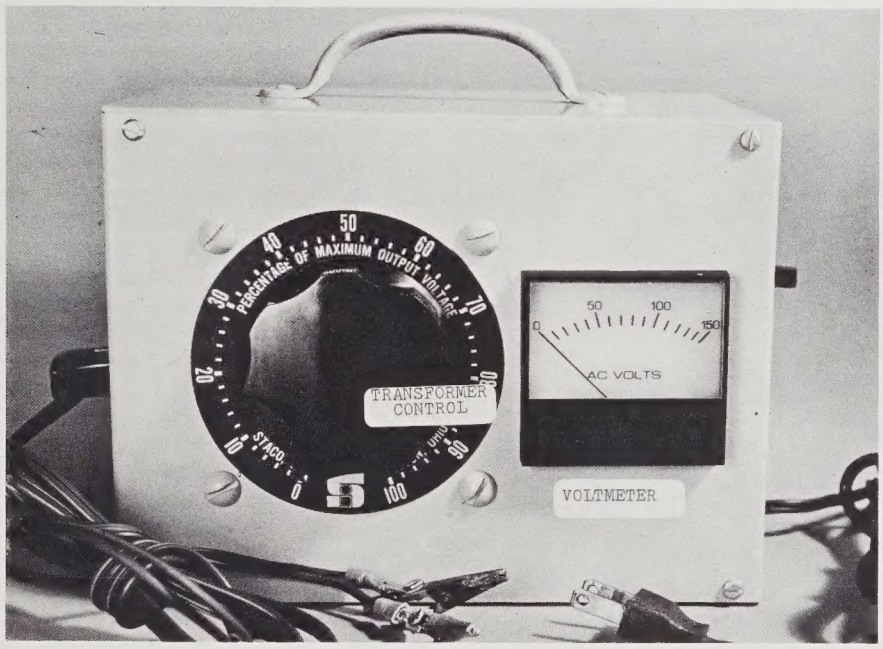



FIGURE 10a

the piece are not stopped-out with a resist (see resists) the entire piece will be uniformly colored. *The transformer is set back to zero volts and the anodizer is turned off before removing the piece from the electrolyte.* (6) the piece is rinsed in water and dried.

There are several variations on step 5 that produce other attitudes: (1) a uniform color oxide film can be produced as described above; (2) areas can be stopped-out with resist allowing only the areas exposed to the electrolyte to be oxidized; the resist can then be removed and a new area stopped-out allowing it to be oxidized.

NOTE: On re-exposure to the electrolyte at a higher voltage, a color formed at a lower voltage will become the higher voltage color. A higher voltage color will not become a lower voltage color on the same re-exposure e.g., a blue formed at 25 volts would become green if re-exposed at 85 volts; conversely, a green formed at 85 volts would stay green if re-exposed at 25 volts. Also, length of the exposure does not seem to influence the color. Starting with the highest voltage color required for the piece is recommended, this will largely eliminate the risk of one color transforming into another on re-exposure to the electrolyte.

(3) An artist's paint brush with a metal ferrule and wooden handle (or other electrical non-conductor) can be connected to the anodizer at the metal ferrule and used as the cathode. The work-piece is the anode. The voltage for the desired color is selected, the brush is dipped in the electrolyte, and the color is painted on the work-piece — anodization takes place between the brush, via the electrolyte, and the piece. The brush will need frequent re-dipping in the electrolyte, especially at the higher voltages where the heat generated by the electricity will cause the electrolyte to boil and rapidly evaporate. Occasional dipping of the brush in pure water will dissolve salts that build up during the anodizing. The brushes will also burn up, and the glue holding the bristles in place melt or dissolve because of the high temperatures generated. Nylon brushes seem to be more resistant than natural bristle brushes. (4) All of the above techniques lead to an oxide layer of uniform thickness forming one color. A wedged shaped oxide film can be formed by immersing the work-piece in a container of electrolyte and pulling the piece out as the voltage is varied (a titanium cathode is also immersed in the container). The results look somewhat like an oil slick on water but the range and placement of colors can be controlled quite well with practice.

WARNING

When working with any of the techniques the artist is handling electrically charged equipment in a wet environment: all work should be done on a wooden or other non-electrically conducting surface, rubber gloves should also be worn.

RESISTS

Almost any of the resists used in etching or plating can be used in the anodizing process. Consideration of the resist's ability to stand up to hot solutions should be noted. Hardground, asphaltum varnish. Microstop ®, Microflex ®, Micropeel ®, wax, and various tapes are all acceptable. Etched metal, having a lightly toothed surface, makes it difficult to get an extremely sharp line with any lacquer-like resists, hard ground and asphaltum work best with this type of surface.

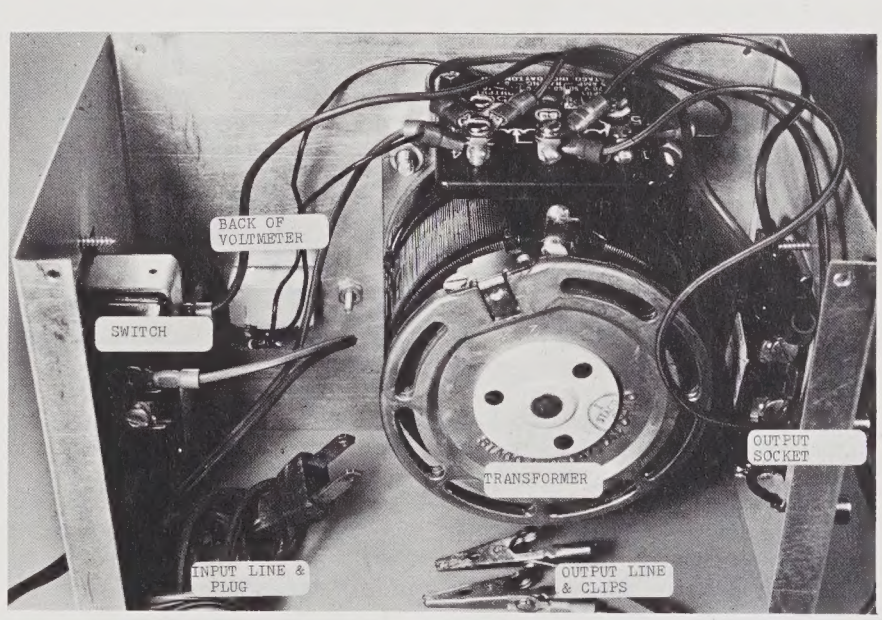



FIGURE 10b

FINISHING

The finish on the parent metal will greatly affect the intensity of the reflected color. Sandblasting gives a subdued, almost flat, color with far less chromatic intensity than a highly polished surface; a lightly etched surface lies somewhere between these two extremes. The selection of the finish places some restraints on the protection from touching the piece needs: body oils are absorbed on the sandblasted or etched surfaces and mute the colors, highly polished surfaces seem to scratch more easily.

SANDING AND BUFFING: The titanium metals are quite hard and are best treated like stainless steels. Sanding with silicon carbide papers and buffing with tripoli and stainless steel rouges works well. Niobium and tantalum are "gummy" metals. Sanding with emery and buffing with tripoli and red or white rouge is usually satisfactory. With all of the metals though, scratches are very difficult to remove and care should be paid to avoid unnecessary scratching.

ETCHING: Etching is usually done with a dilute hydrofloric acid solution or a hydrofloric acid-nitric acid bath. The metal's oxide film must be dissolved for the acid to attack the metal. All solutions are used at room temperature. Great care should be taken in mixing and storing the solutions because of their highly corrosive nature: wear rubber gloves and a face shield when mixing or using; strong positive ventilation is almost essential (a chemical lab type fume hood is recommended). Do not smoke because flammable hydrogen gas is produced during the etching process.

Etchant No. 1 for titanium, zirconium*, and hafnium*: 10 ml Hydrofloric acid** + 100-200ml Water.

Etchant No. 2 for titanijm, zirconium*, and hafnium*: 90ml Nitric acid + 10ml Hydrofloric acid + 1000 ml Water. This is the best etchant I have used for titanium.

Etchant No. 3 for niobium and tantalum: 50ml Hydrofloric acid + 25ml Nitric acid + 500ml Water. If the reaction is too vigorous dilute with water.

Chemical bright-dip for zirconium, hafnium, and tantalum (courtesy of Teledyne Wah Chang Corp.): 1st dip in the following solution: 125ml hydrofloric acid + 500ml Nitric acid + 500ml water. 2nd rinse the piece in running cold water. 3rd dip in the following solution: 500ml Nitric acid + 500ml Water (if the piece does not have dark stains this step may be omitted). 4th rinse in water and dry.

Chemical bright-dip for niobium (courtesy Teledyne Wah Chang Corp.): 1st dip in the following solution: 300 ml Nitric acid + 300ml Sulfuric acid + 100ml Hydrofloric acid + 300ml water. 2nd rinse in running cold water. 3rd dip in the following solution: 350 ml Nitric acid + 200ml Sulfuric acid + 350ml Water. 4th rinse in water and dry. This dip has been recommended, I have no personal experience with it.

Titanium can also be photoetched using a hydrofloric acid etch or a hydrofloric acid-nitric acid etchant and an appropriate photosensitive resist e.g., Kodak Metal Etch Resist or Kodak Thin Film Resist. It could be assumed that the other titanium metals, and probably niobium and tantalum, could be similarly etched.

*Zirconium, and to a lesser extent hafnium, often form black stains in this etchant. A water rinse followed by a dip in 50% Nitric acid-Water will usually remove the stains.

**All concentrations are for standard concentrated acids. Dipping the titanium metals in concentrated hydrofloric acid without dilution may cause an explosion (see health/safety section).

PLATING

The metals cannot be plated on other metals except in a molten salt electrolyte, and then only with difficulty. If a thin plating is required explosively clad materials are available from some suppliers. The metals can be plated with other metals if an immersion coat of copper or zinc is first applied. The following solutions are from the Metal Finishing Guidebook and Directory*:

SOLUTION NO. 1: 200g/liter Copper Sulfate + 480g/liter Sulfuric acid + 24g/liter Aluminum Sulfate + 0.1% Wetting agent. The solution is used at room temperature. The metal should be thoroughly cleaned before immersion.

SOLUTION NO. 2: 100g/liter Sodium Dichromate + 5g/liter Copper Sulfate + 50ml/liter Hydrofloric acid. The solution is used at 210 degrees F. Thoroughly cleaning is required before immersion. A note is made concerning this solution that zinc sulfate may be substituted for the coppersulfate resulting in better adhesion.

ENAMELLING

Enamel does not adhere to titanium, it will flake off in large pieces on cooling. A possibly explosive combination may result if an enamel containing borax is applied to zirconium (hot zirconium and borax have been known to explode). *Caution should be exercised in any experiments with hot metals and enamels* (or any chemical).

FORMABILITY

A set of numerical parameters, often referred to as "mechanical properties" in metals data books, can be used to give a more objective feel to an unfamiliar metal than statements like, "it's similar to copper", similar is a vague word. A reference to the parameters of familiar metals would enable the metalsmith to understand the working properties of unfamiliar metals. The parameters aid in accurate communication about the physical character of metals. Fig. 2 lists the properties of the metals in this paper along with the same properties/parameters for more familiar metals (notice should be paid in comparing scientifically pure metals with commercially pure metals: the very pure scientific grade may be much more ductile than the commercial grade). Unfortunately, qualities like ductillity and malleability are not measured by a single parameter, there is also some arbitrariness (subtleties) as to what parameters define these characteristics. However, two useful indecies are *percent elongation* for ductility, and *yield strength* for malleability. The greater the percent elongation the greater the ductility. Yield strength is a measure of the minimum force needed to permanently deform (shape) a piece of metal i.e., to produce "plastic deformation" (forces less than this will produce no permanent deformation and the piece will simply spring back to its original form when the force is relieved, this temporary deformation is termed "elastic deformation").

*The Metal Finishing Guidebook and Directory, p. 161, 1977, Metal and Plastics Publications, Inc.; Hackensack, NJ.

FIGURE 11a
SCHEMATIC DIAGRAM OF ANODIZER

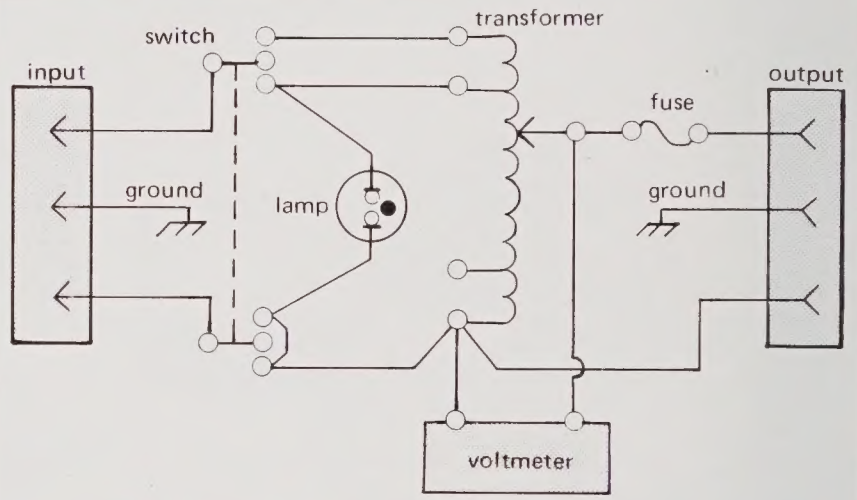



Figure 11a courtesy of Theodore Swift and Staco, Inc.
Fuse should match maximum output of the transformer.

FIGURE 11b
COMPONENT DIAGRAM OF ANODIZER

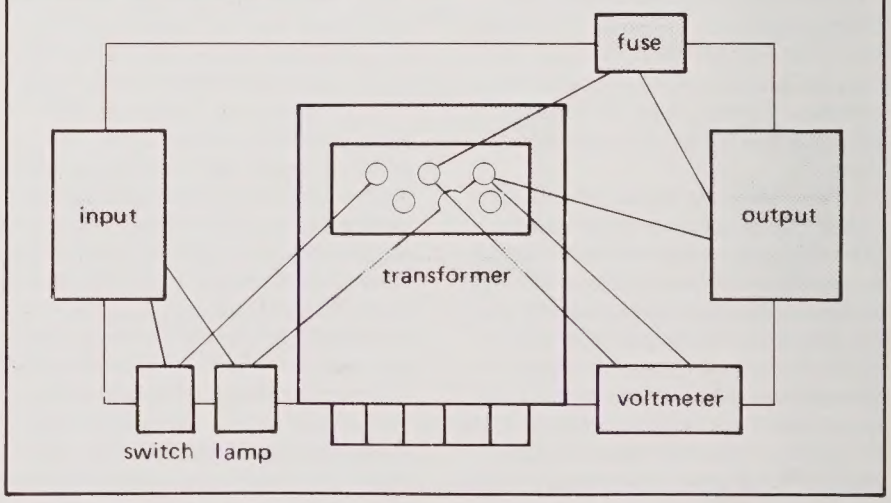
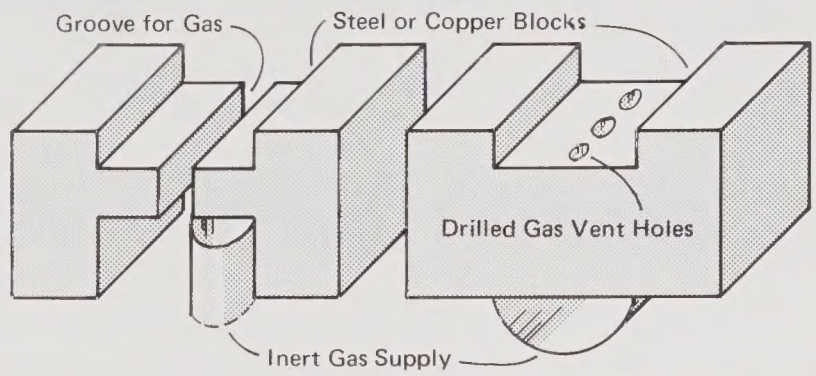


FIGURE 13
BACK-UP GAS FIXTURES FOR TIG WELDING




FORMING—When forming the metals two problems are immediately encountered: (1) High purity metals are essential. If as little as 0.2%-0.3% oxygen, nitrogen, or hydrogen is present the formability may be halved (compare the differences in yield strength for the two purities of titanium and zirconium in Figure 2). (2) There is no way for a conventional metalsmith's shop to anneal the metals. The metals must be annealed for a period of several hours in a very high vacuum. There appears to be no easy way around this problem (a suggestion of annealing in a kiln [electric] filled with inert gas e.g., argon, is unsatisfactory because of trace amounts of oxygen, etc. in the gas would cause severe embrittlement). Some distributors may be willing to anneal work for you if you send the piece in to them — check with them first before you try this approach.

The titanium metals are much more difficult to work than the metals most metalsmiths work with. Work hardening also seems to occur more rapidly than with conventional metals. The metals are usually harder than most forming tools e.g., mandrels, hammers, stakes, unhardened dies, etc., and thus will damage these tools: hardened tools should be used. If forming is required, specify the highest purity metal obtainable, fully annealed, and in the thinnest gauge aesthetically possible. Hot working is possible, but one should be fully aware of the pyrophoric nature of the metals; the thick oxide coat formed with hot working will have to be mechanically removed or etched away. Spinning is possible if there are no sharp radii curves or angles, but again the problem of annealing will arise.

Niobium and tantalum are more amenable to forming than the titanium metals (note the increase in percent elongation and decrease in yield strength vis-a-vis the titanium metals). Annealing is still a problem but the initial malleability will allow for greater forming. Again, the metals must be of highest purity and fully annealed. Chasing and repousse are possible with thin metal (26-28 gauge); pitch should be removed with solvents rather than flame to avoid hardening. Spinning is possible, but the metals thin easily.

FIGURE 12

| Metal | Turning Feed ipr | Speed sfm | Depth in | Tool Geometry | Drilling Feed ipr | Speed sfm | Tool Geometry | Both Coolant |
|---|---|---|---|---|---|---|---|---|
| Titanium | 0.015 r<br>0.007 f | 100 r<br>110 f | 0.150 r<br>0.025 f | 1) 5<br>2) 0<br>3) 8<br>4) 0.125"<br>5) none | 0.002 1/8" hole<br>0.006 ½" hole | 50 | 135 ¼"<br>118 ¼" | Soluble type heavy flood CIMCOOL or SOLVAC |
| Zirconium | 0.020 r<br>0.005 f | 80-100r<br>150 f | 0.125-0.025r<br>0.010-0.040 f | 1) 10<br>2) 15<br>3) 10<br>4) 0.030"<br>5) yes 3/16" | 0.005-0.010 | 40-60 | 118 | As titanium |
| Hafnium | AS ZIRCONIUM | | | | | | | |
| Niobium | 0.008-0.012 r<br>0.005 f | 60-80 r&f | 0.125 r<br>0.030 f | 1) 30-35<br>2) 15-20<br>3) 5<br>4) 0.025"<br>5) no data | AS COPPER | | | Air, Rapid Tap, etc. |
| Tantalum | 0.008 r<br>0.005 f | 50-60 r&f | 0.060 r<br>0.015 f | 1) 5<br>2) 10<br>3) 5<br>4) 0.020"<br>5) no data | AS MILD STEEL | 30-40 | 118 | as niobium |

r—roughing cut
f—finishing cut

Tool Geometry: 1) Side rake 2) Back rake 3) Side and end clearance 4) nose radius 5) chip breaker

Carbide tools are preferred for the titanium metals: high speed steel tools for niobium and tantalum.

CAUTION—ALL OF THE METALS ARE PYROPHORIC IN AIR!

CUTTING ACTIONS—Cutting actions like sawing, filing, drilling, and tapping are considerably more tedious and damaging to tools with the titanium metals than with the precious metals. A good supply of replacement tools, especially drills and saw blades, should be kept on hand — if the tools do not break they will dull out. Frequent use of light oils, e.g., sewing machine oil, is recommended for hand tool processes and essential in machine tool use. Coarse files and saw blades are recommended. Niobium and tantalum resemble hardened copper with regard to cutting actions, and except for galling, present no special problems.

MACHINING—The data given in Fig. 12 lists recommended tool geometry, and cutting feeds and speeds for the metals. All of the metals, but especially tantalum, have a tendency to gall or seize and subsequently work harden. If galling does occur the tool clearance angles should be increased. Carbide tools are recommended for the titanium metals; high speed tools for niobium and tantalum. Heavy use of coolant is required with the titanium metals and desirable with niobium and tantalum because of the poor heat conductivity of the metals. *Caution:* all of the metals are pyrophoric, especially hafnium and zirconium, when in a finely divided state such as lathe turnings — AVOID ACCUMULATION OF DUST, CHIPS, AND TURNINGS. Teledyne Wah Chang Corp. suggests storing chips etc. away from the working area in a nonflammable container filled with water with a thin layer of oil floating on it to reduce the water's evaporation. If a fire does occur do not use water; use dry sand (see health and safety).

SOLDERING AND WELDING—None of the metals can be soldered or brazed*. All must be welded in an inert gas atmosphere. Tungsten Inert Gas (TIG) welding is the most commonly used process (plasma arc, and electron beam welding may also be used). A complication arises though in that the back of the weld must also be shielded (Fig. 13) shows a couple of possibilities for running inert gas to the backside of a piece. Preferable to back shielding is welding in an inert gas filled chamber (the chamber is first evacuated and then filled with inert gas). The units are usually built to the specifications of the user at a cost of $1000 and up. The work and torch are sealed in the chamber and the operator handles the torch via rubber gloves sealed to the frame. Extra high purity inert gas should be

*Some experimentation using copper plated metal with exotic filler rods/solder has been done, success has been limited.

used or embrittlement might occur through absorption of trace reactive gases. A good weld will not show any oxide coloring.

Typical TIG set-up:

Shielding gas – Argon plus back shielding
Electrode–2% Thoriated tungsten
Welding current–DC straight polarity
Chill bars recommended
Gas flow rate–approximately twice stainless steel
Amperage–approximately twice stainless steel

Metal must be clean and degreased. The metals do not weld well to other metals because of the formation of intermetallic compounds and subsequent joint embrittlement. Consultation with a welding engineering is strongly recommended before attempting any welds.

CASTING–Casting is out of the question in a metalsmith's shop. The metals will burn violently in air long before the melting temperature is approached; secondly, the temperatures required for melting cannot be achieved except by special processes (see production of the metals). Suppliers can give the artist names of commercial casters, however, the cost and design limitations will probably be prohibitive.

HEALTH AND SAFETY--As of January 1979, the toxicity of these metals in their pure or oxidized state is thought to be minimal: this may not be true for their compounds, some of which are known to be toxic. Toxicity may be lower than that of many metals commonly used by metalsmiths; however, this is not an endorsement or certification of their safety. In some cases, as with niobium and hafnium, there is very little data on prolonged contact with the metals or compounds. When working with any new or exotic material the artist must make it his or her duty to thoroughly research the health hazards of the materials AND up-date this information frequently. The dusts of the metals should be avoided (with the same degree of caution used with other conventional metals.) Titanium and tantalum are both used in implants for human surgery, this would seem to indicate some degree of safety. All metalsmiths should be familiar with the following book which lists known health hazards of materials: *Dangerous Properties of Industrial Materials*, 4th edition 1975, N. Irving Sax, Van Nostrand Reinhold Co.; New York, New York.

The major safety problem stems from the pyrophoric nature of the metals. This is not of any real significance when dealing with sheet (except foil) or wire, but should be considered a definite problem with the dusts and metal turnings – avoid accumulations of either. The titanium metals, especially zirconium, react quite violently with concentrated hydrofloric acid, the hydrogen formed during the reaction may ignite by the heat of the reaction. None of the metals should be allowed to contact florine or chlorine gas. Zirconium has been known to explode when heated with borax (the component of some enamels and most hard solder fluxes) and some alkali hydroxides. Titanium may form an explosive compound when mixed with red-fuming nitric acid; also avoid any contact of titanium with liquid oxygen due to a very high explosion danger. This last caveat may seem silly, but metalsmiths tend to be extremely curious in searching for new materials, or combinations of materials, with which to better express themselves – liquid oxygen may be a tame curiosity in the end. When dealing with new combinations of materials in a chemistry-like situation, or under any extreme condition of heat, or pressure, etc., caution is required. The National Fire Protection Association (NFPA) publishes an excellent guide book on how to safely deal with new (and familiar) materials, it also includes an especially good section on hazardous reactions between materials: *Hazardous Materials*, National Fire Protection Association, 470 Atlantic Ave., Boston, MA, 02210.

SOURCES FOR THE METALS–Fig. 14 is a list of known or recommended suppliers. There are many other suppliers throughout the country. Check the "Yellow Pages" of any major city's phone book, or look in the *Thomas Register* under the name of the metal desired. Most suppliers will give the names of local fabricators who buy from them; these fabricators are a good source of information and scrap (scrap is often available at ½ to ¼ the cost of new material), but DO NOT expect them to be familiar with metalsmithing terminology or always pleased to give free advice. When buying new material two problems will be encountered: (1) Most firms have a minimum order which is usually between $50 and $200, a $100 minimum is normal. There are generally no price-lists; call for quotes. (2) The availability of mill products varies considerably. Most suppliers cannot change the shape or thickness of sheet or wire, and will not, if they could, on any order approaching a minimum order. Sheet, plate, round wire, and extruded tubing/pipe are standard mill products. Special shapes are generally made to order, but only on industrial size orders. I recommend purchasing scrap from fabricators for any initial experiments.

FIGURE 14

| COMPANY-ADDRESS | METALS SOLD | | | | | COMMENTS |
|---|---|---|---|---|---|---|
| | Ti | Zr | Hf | Nb | Ta | |
| Astro Metallurgical<br>3225 Lincoln Way W.<br>Wooster, OH 44691<br>(also, Los Angeles) | x | x | | | x | Friendly, accept small orders $35-$50 min., supplier |
| Fansteel Metals<br>1 Tantalum Place<br>North Chicago, IL<br>60064 | | | | x | x | Usually $100 min. Primarily sell tantalum, manufacture/supplier |
| Gehning, Inc.<br>P.O. Box 0, Dept. T<br>Syosset, NY | | | x | | | |
| Leico Industries<br>250 W. 57th Street<br>New York, NY | x | x | x | x | x | |
| Teledyne Wah Chang<br>P.O. Box 460<br>Albany, OR | | x | x | x | x | Usually $100 min., very friendly, large manufacture/supplier |
| Futura Titanium<br>P.O. Box 5004<br>West Lake Village,<br>CA 91359 | x | | | | | no direct information, but recommended by others |
| Timet<br>400 Rouser Rd.<br>Pittsburgh, PA | x | | | | | not especially friendly on small orders, $100 min., large manf. |
| Titanium Sales Corp.<br>17T Industrial Rd.<br>Fairfield, NJ 07006<br>Also offices in: Montreal, Canada; Sao Paulo, Brazil | x | | | | | |

Each company's minimums may change at any time; different types of mill products are usually not combinable to reach minimum order. My best experience has been with Astro Metallurgical (Los Angeles office) and Teledyne Wah Chang.

CONCLUSION–A caveat. The refractory metals are immediately seductive because of their "easy" colorability, but beyond the color lies form, and hopefully within the form is content. They have a tremendous potential for producing pieces that are superficially extraordinary. The question often arises as to if we are not just painting on metal when we use the group for its colorability, maybe, but as long as the "painting" is good what difference does it make? Why is canvas any more suitable for painting than metal? Silver, copper, and gold also have a color that any conscientious metalsmith would consider in any piece that they make. Like more familiar metals they also have physical properties and characteristics that may be useful or limiting to the artist: titanium's lightness and strength could find uses in its own right; tantalum's and titanium's extreme hypoallergenicity may make them useful in producing jewelry for people with allergies to most other metals; niobium, tantalum, and especially hafnium have intrinsic monetary value, which is an associative "value" of jewelry; tantalum's unusual natural color may also be useful. The metals do have many limitations. Notably the titanium metal's resistance to forming on the jewelry scale, and their inability to be hard soldered. But their many unique characteristics must allow them a place in the store of materials from which the artist can draw on in their efforts to better express themselves.

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# EDITORIALS

Dear Editor,

I would very much like to see my work published in the Journal . . .
(name withheld at editor's discretion)

EDITOR'S NOTE: Lately we have had several letters similar to the one above. Unfortunately, we do not have a section in the Journal allowing publication of unsolicited photos and publicity materials. Although we are printing autobiographies and biographies of some metalsmiths, these are by invitation only. Invitations are based on acceptance into SNAG as a pro-member (since this is juried and recognizes a certain level of achievement); an extremely accomplished metal person who has spent most of his life in the field; a foreign metalsmith (thus exposing our readers to international influences); or an author of a technical paper accepted and presented at the annual conference.

For those not meeting the above criteria, we would suggest that the next time your work is featured in an exhibition, encourage someone to review the exhibition. Send us the written review, along with a few photographs. This will help insure a Journal with as many facets as possible.

Dear Editor,

After being thoroughly conferated in Boston trying to get by on an average of 2 hours of sleep per night and a 12 hour drive home including car break-down and speeding ticket, my communication for two days was a mix of mono-syllibic garble and blank stares. My husband diagnosed the condition as an advanced case of S.N.A.G.-lag.

Hannelore Gabriel

Dear Editor,

. . .My husband and I have arrived in Munich and we will be here at least until August. We would like to exchange or communicate with other Americans that might be traveling in the area. . . .

Katherine Burris Stanley
Strasslacher Str. 2, D-8000 Munchen 71, West Germany
(phone) 791-3280

Dear Editor,

Some time late in the conference, someone asked me "Who are you?" Since it had been several years since my last identity crisis, I had no ready answer. An obvious one would have been "I'm a goldsmith," but after two days of rubbing elbows, etc, with my more successful colleagues, I feel inadequate to the title. I do not teach at the university level, indeed I do not even have an art school background. I have not yet produced a piece that was too fragile, too complicated, or too dangerous to wear. I do not deal with prestige galleries but directly with the people who buy my work because I enjoy the feedback. I have never had a craving for moonstones or dressed like a cat burglar who's collided with a loom. Do all these failures disqualify me altogether? I simply work metals and stones entirely from rough materials and find great pleasure in this — also I cover my expenses. Goldsmithing is only one facet of my life, albeit the one that makes all the others shine. Is there room for me in SNAG? Are there others who share my less than complete devotion to self-expression? And, finally — what is a Goldsmith?

Janine R. Hendricks
6244 Somerset Dr., North Olmsted, OH 44070

P.S.—What I really look for in a conference such as we just attended is a sharing of thinking and resources. This was sadly lacking, at least during the official schedule. Wouldn't it be exciting to have available a directory of pro-members identifying their favorite media and perhaps including a paragraph by each as to where they feel their work is leading?

Dear Editor,

I have just seen a copy of your Goldsmiths Journal and would appreciate your sending me a copy and details of membership to SNAG.

In the meantime, I would like to tell you about a special person in Charlotte, NC — Anne Taussig, an associate member of SNAG. She has opened a lot of doors for those of us in this area who want to seriously learn metalsmithing, but for various reasons cannot afford to go to four years of college or arts school. Anne is teaching metalsmithing in her studio for very little monetary compensation because most of her students are like me — married and a full-time bank teller with three small children. We share Anne's love of her craft and she shares with us her knowledge. She is never too busy for one of us to call and talk about a piece we are trying to do at home.

This is my personal thanks to an unselfish person — she is truly a credit to her profession and the people who taught her!

Katherine Wilmer

P.S.—Thank you to all craftsmen who take the time to help us beginners, either by answering our questions or offering a word of encouragement.

Dear Editor,

Could someone explain and give diagrams of how "foxtail weaving" is done with sterling silver wire?

Klaus Kallenberger

EDITOR'S NOTE: Because of the variety and nature of the Letters-to-the-Editor, SNAG and the Goldsmiths Journal cannot verify or be responsible for the material these letters may contain. It is therefore suggested that you carefully analyze and verify all information herein. We will consider publishing responsible letters which refute any information we publish.

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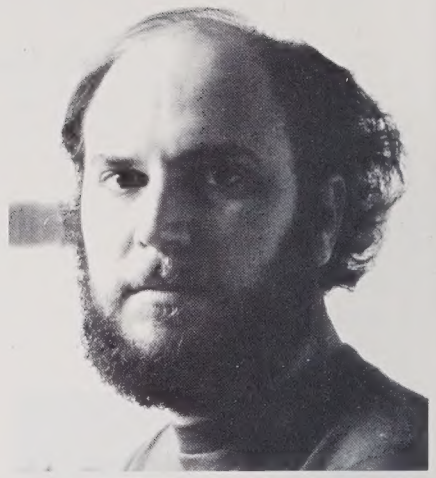
## PEOPLE

### AUTOBIOGRAPHY

**by Joseph Hall**



*Joseph Hall*

Before coming to metalsmithing my background was in microbiology (B.S.) and urban planning (M.S.). Both fields left me partially unsatisfied. It is difficult for me to determine what was lacking, but perhaps it was an end product, and object, that would give me a mode of expression that was not entirely abstract or rational, and with which I had physical rather than purely intellectual involvement. Both fields frame questions (puzzles?) and yield paper answers. The techniques, many of which I found quite beautiful, are irrelevant; the product of the research solves the problem, but by necessity it is without emotional content or vitality: it is objective because they are both sciences and follow scientific methodology.

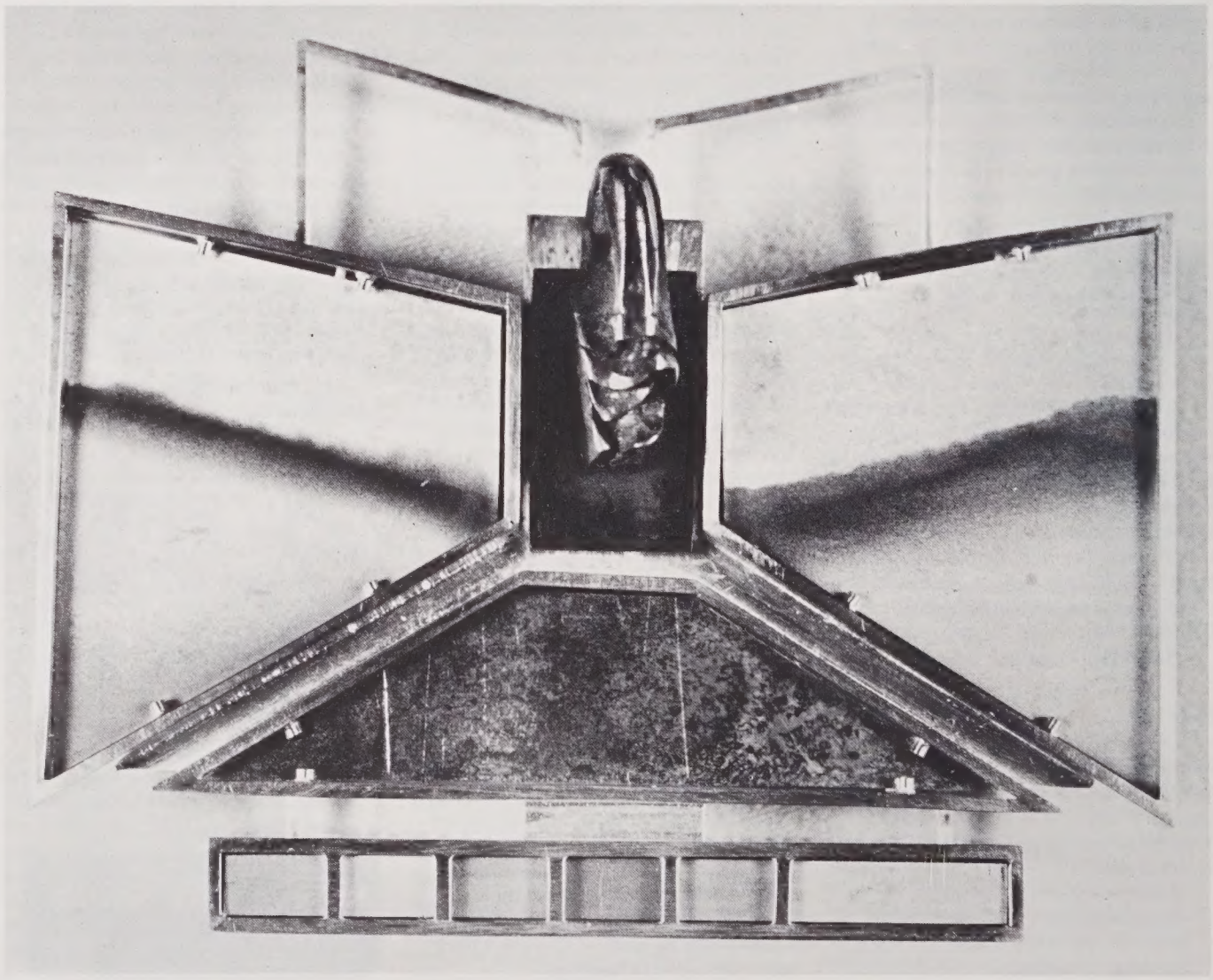
Their influence on my metalsmithing is a two-edged sword. On one side, when a problem with techniques or materials arises, I am aware of research processes that usually lead to their resolution. On the other side, I can be drawn too far into the problem solving, losing sight of the goal of the research — to produce an object that communicates. Analysis and research can answer technical questions and perhaps heighten awareness of aesthetic considerations, but the communicative content of a piece transcends either analysis or research. I see this as a major difference between science and art. With science the product must be non-emotional and communicate objectively; with art the product must be emotional and communicate subjectively. The intentions of a piece mirror the value set, including biases, of the artist.

This schism between art and science initially led to my biggest problem with art. Art communicates, at least partially, in a nonverbal way; like music the content cannot be correlated to a direct verbal translation— verbalness may be part of it, but there is always more. The question then arises as to how do you put nonverbal statements into a piece if you think verbally? If felt at first that I must have a completely satisfactory answer to this question before I could proceed. My resolution to this question, though somewhat less than complete and wholly satisfactory, is to start with a verbal core (a statement or design problem) for a piece and let the nonverbal build from the core. This method allows me to work, but I am still mulling over the question.

My latest pieces have a predominate theme: they are instruments for viewing "landscapes" or environments, worldly or otherworldly, alluring or repelling, enterable only in imagination. Most of my work incorporates refractory metals either because of their colorability or, as in the case of titanium, because of its strength and lightness. I do not want to be limited by them, however. Material or technique is always secondary to expression, but conversely material and technique facilitate expression. I am attracted to qualities of materials scientists and engineers overlook. Titanium, for example, is more than a lightweight, high strength, high melting metal. There are qualities of it that cannot be defined by engineering parameters. It is a natural marvel in its own right, part of the universe both the titanium and I share. There are many other metals not used by metalsmiths that have intriguing characteristics which I am beginning to investigate for use in my work.

Aside from microbiology and urban planning/urban design, most of my experience has been in postsecondary education. I taught in the engineering program at the University of Wisconsin where I initiated a course in photography for engineers and scientists. I have also been developing and teaching in a program on the techniques of trade jewelry for the Seattle Community College system. I have also worked as a teaching assistant with John Marshall at the

*Joseph Hall, pin, sterling, titanium, steel*

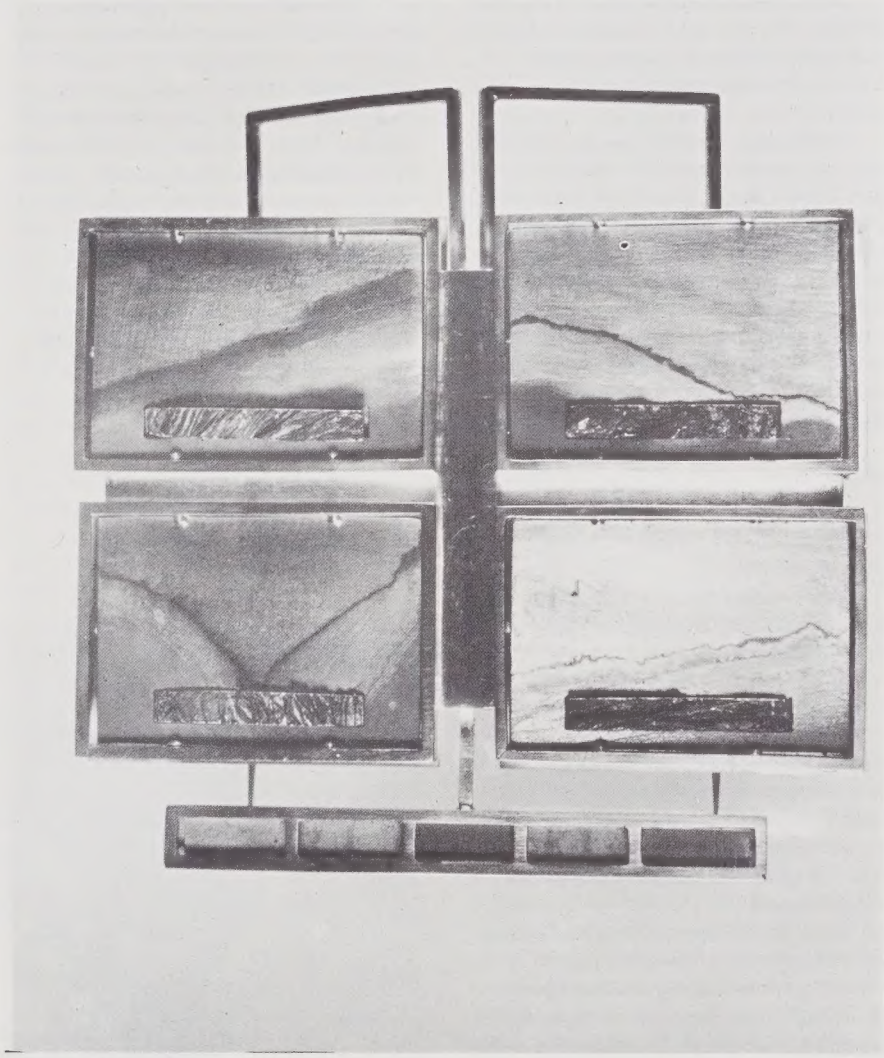


*"There are many other metals not used by metalsmiths that have intriguing characteristics which I am beginning to investigate for use in my work."*

*"The techniques, many of which I found quite beautiful, are irrelevant. . ."*

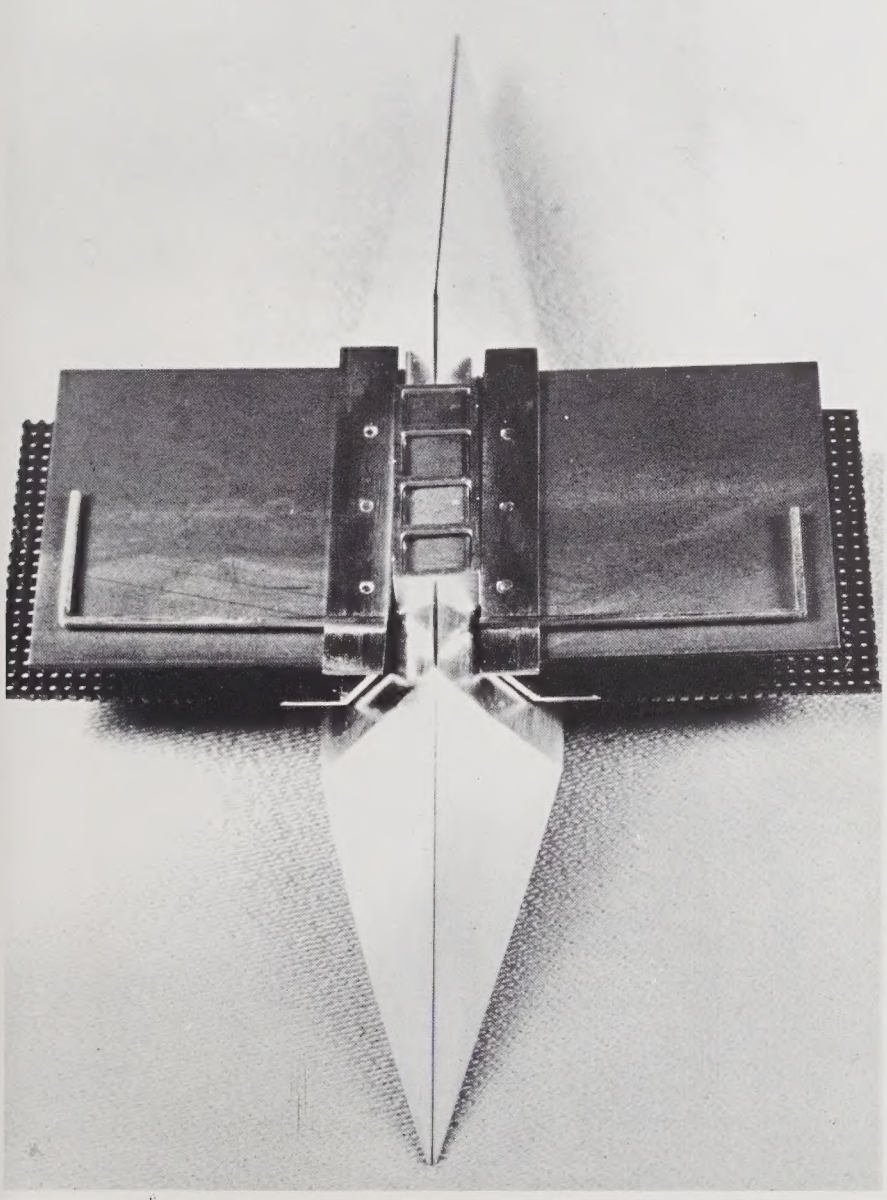
University of Washingotn. Teaching allows me the freedom to get involved with research (both in materials and aesthetic) and receive feedback/criticism on the results. My goal is to get involved with a college or university metalsmithing program where I can continue researching and keep making art.

I am an eclectic, and metalsmithing has seduced me to it by its eclecticism of materials, approaches to art, and techniques. Metalsmithing has allowed me to research, teach, and express my thoughts. I am amazed at how well it fits me and the pleasure it gives me.



*Joseph Hall, pin, sterling, titanium, aluminum-gold alloy*

*Joseph Hall, pin, sterling, titanium, brass*



(EDITOR'S NOTE: Joe is currently completing his degree work at the University of Washington-Seattle. He is available for workshops on the use of titanium and other refractory metals.)

## PETER VEDEL TAANING
## AUTOBIOGRAPHY

This is the plain framework of my professional life, built upon solid dates and locations. It even quite comfortably assumes a future to come —

Until I was twelve, I experienced my first contact with the metier in a dyer's workshop. The forge especially caught my attention, and soon I was completely absorbed in the manufacturing of a jam spoon. Whatever happened to this juvenile masterpiece is anybody's guess, but I certainly remember the thrill of the experience, compared to which other childhood games seemed rather dull.

Accordingly, when I finished school, it was not a difficult decision

". . .the whole concept of apprenticeship, in its pure, traditional form is anonymous."

to continue my education in this field. I became apprenticed to the most renowned Danish establishment A. Michelsen, for a period of four years. At that time, apprenticeships still followed the traditional course; our main thrust being to manufacture accurate copies of original pieces, either by undertaking endless measurings of those objects or by using workshop drawings. Some of these were so ancient they fell apart between your hands, just like that— and you would have to operate with a mischievous puzzle instead.

Obviously there wasn't much "thrill" to speak of. The working day was 8½ hours. In order to endure the monotony and obtain at least a frail taste of freedom, I used to make myself invisible for ½-1 hour per day — hiding in a closet and doing some reading of my own.

As a most welcome interruption of the routine, however, came a study tour at Eire, in 1963. I participated in an international craftsmen's competition and honorably scored a gold medal. My test piece two years later eventually granted me the certificate of completed apprenticeship, plus an additional medal, with holloware as my specialty.

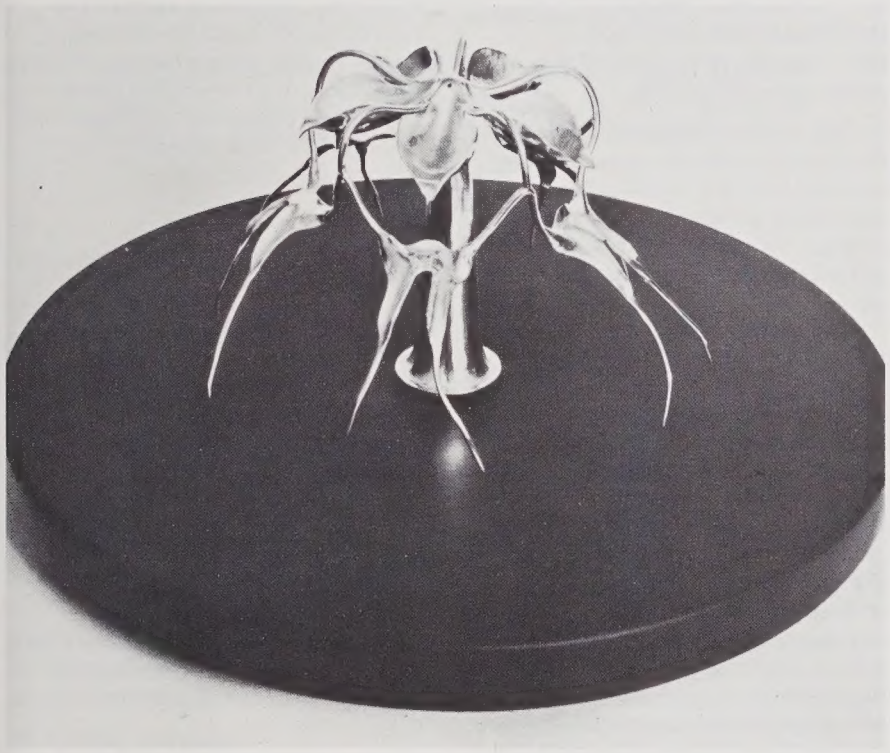
Then began a most satisfactory period of self-appointed studies and journeys. I travelled to Stockholm, Paris, and Germany, visiting museums and enjoying life. Although this "rebellion" from the past four years of hard discipline was necessary, I soon realized how effectively my basic craftsmanship had settled itself—unconsciously, so to speak.

A couple of years later I found myself in school again, this time in the High School of Arts Goldsmith's Dept. During my two years here, I developed along my own line, and added an "artistic identity" to my basic craftsmanship.

Ever since, my work as a silversmith has oscillated between these two poles: as a "craftsman" I harbour deep-rooted feelings of duty and respect towards the material and tools; while as an "artist" I just ardently despise the idea of "perfectionism." When regarding my apprenticeship from a distance, I am able to dis-

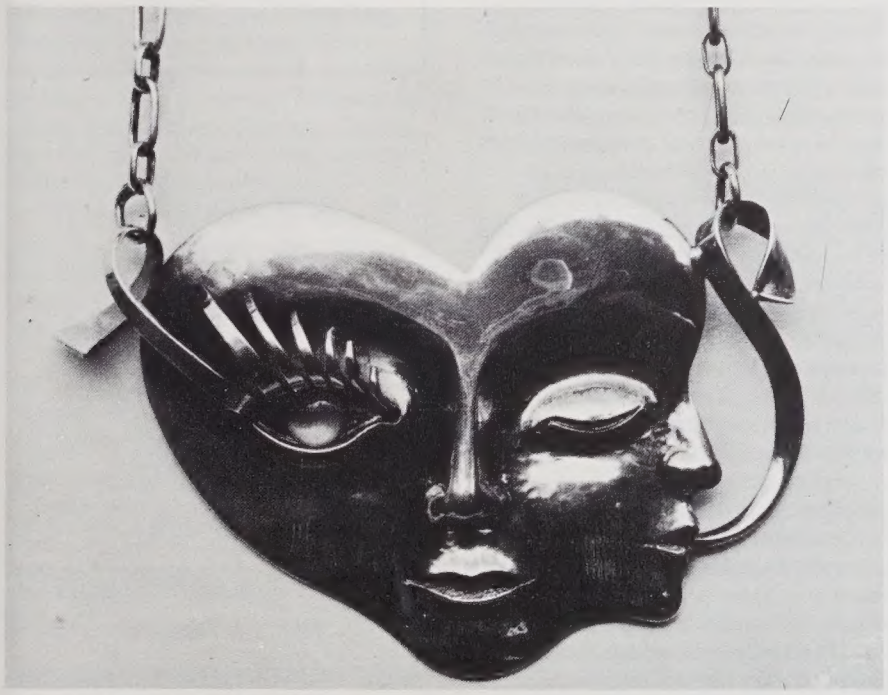
*Peter Vedel Taaning*

*Peter Vedel Taaning, drinking cups, sterling*



*Peter Vedel Taaning, "Fountain," sterling and slate*

*Peter Vedel Taaning, necklace, sterling and moonstone*



tinguish a pattern, which goes beyond the mere "boredom" and "training of your self-discipline."

Indeed, we were not brought up to become artists — to express ourselves! On the contrary, the whole concept of apprenticeship, in its pure, traditional form is anonymous. Always the skill of the hand, the proper use of tools and materials, the professionalism/perfectionism, had to be transferred from master to apprentice, in an unbroken chain, which began somewhere back in the Bronze Age. Once this chain was essential — otherwise production would cease. Artful, bold, and extravagant solutions were secondary events — still subordinate to the tranquil price of the hand. Accordingly, forms and techniques changed slowly.

But certainly, man's conditions have changed rapidly. From an essential, utilitarian point of view, the craftsman is no longer an essential. In this age of machine — the master's fingerprint is no repetitious toil of the apprentice, is therefore not only anachronistic, but in a sense, absurd. We know that to the majority of our

"My work as a silversmith has oscillated between two poles: that of craftsman and that of artist. . ."

would-be customers, the subtle distinctions between the tracks of our slow hands, and those of the machine, are hardly noticeable, and definitely not worth paying for.

The craftsman cannot revolt, but the artist can! So my first works in "freedom" may be regarded as a prolonged revolt. These were objects meant to provoke, not to wear or use. My imagination free-wheeled from maritime structures (buoys, riggings) to cages, bars, sculptural imprisonments, towers of frail threads, combined with feathers of rare birds, etc. Gradually, however, this period of revolt devoured itself. In the search for new ways, as so often happens, I turned back to the "old ones."

The extravagant manifestations I have canalized, have been for theatrical or ritual purposes, in the widest sense of the word (e.g. costume works). As for the remaining part of my work, I am, at present, preoccupied with the "glorious past"— the Viking period, and its interaction with the Oriental impulses. I find inspiration in the elementary expressions of the human face and body, imperceptibly turning into masks, and direct the changes of colors and expressions through polishing phase.

In order to achieve even more striking effect with color, I have undertaken experiments with combinations of precious metals like iron, brass, and copper. Especially rusty or verdigrised plates have made delightful contrasts to the reflecting surface of the silver. At the same time, I have taken great pleasure in solving more limited problems, such as designing light fixtures for industrial purposes. Here, copper has proved worthwhile owing to technical/economic considerations.

The experience of teaching has certainly implied another way of learning. Fortunately, I've had no apprentices in the traditional sense of the word, including the duty of developing future craftsmen—my pupils. I don't really think that I would be able to put up with that kind of inverted recognition.

By now, the education of the silversmiths in Denmark has changed considerably. Theoretical matters have been incorporated to a higher degree, but not all of the problems have been solved. My own attitudes have changed too. I expect, and hope for, still more changes to come.

One way to anticipate this might be to glance behind the walls of Europe, to the U.S.A. As far as I understand, the education and working conditions for metal artists there present some striking differences to ours. If I find employment possibilities, I should very much like to cross the Atlantic someday — to study, while working, and work while studying.

# INFORMATION

## PUBLICATIONS

### SNAG EUROPEAN EXHIBITION CATALOG

The SNAG European Exhibition catalog is available from the SNAG Book Department, 4835 E. Cheryl Dr., Paradise Valley, AZ 85253. It is 48 pages and contains two full pages on each of the 39 metal artists. Each artist has a photo of the artist, a photo of a piece, a biography and statement. Cost is $10 for non-members and $5.50 for SNAG members. The usual 30% SNAG discount DOES NOT APPLY to this catalog, since it is built into the reduced price. Make check payable to SNAG Book Dept.

### TECHNICAL PAPER BOOK TO BE AVAILABLE

SNAG is now in the process of assembling a book that will contain all of the technical papers presented at past conferences. This book would be an excellent addition to any school or personal library and will sell for around $7-$10. To reserve your copy and to insure that a sufficient number are printed, write Tom Markusen, 17218 Roosevelt Highway, Kendall, NY 14476, stating how many copies you would like to order.

The Crafts Report, the news-monthly of marketing, management and money for craft professionals. For subscription information, write. The Crafts Report, 700 Orange St., Wilmington, DE 19801.

*Crafting Turquoise Jewelry* by Robert Powers and Marc Barasch, brings the best of traditional and modern turquoise design as well as basic jewelry making techniques into your workshop. *Foilcraft* by Cyril Marshall is an illustrated guide to the ancient art of sculpting with metal foil (retail price $12.95). To order both of these books, send $20.90 (ship postpaid) or to order copies of *Crafting Turquoise Jewelry*, send $12.95 for each, plus 50 cents per book, to: Stackpole Books, P.O. Box 1831, Harrisburg, PA 17105.

Simmons Refining Co. publishes a newsletter entitled "Simmons Precious Metaletter." For more information on this publication, write: Simmons Refining Co., 4105 W. Chicago Ave., Chicago, IL 60651.

The Art Hazards Information Center has these following bulletins available:

1. Aerosol Spray Adhesives and Other Sprays
2. Face & Eye Protection
3. Gloves
4. Photography
5. Reproductive Hazards from Art Materials
6. Respirators
7. Flammable & Combustible Liquids
8. Traditional Sculpture and Casting
9. Ten Safety Rules for Artists and Craftspeople

Also these articles and pamphlets:

"Health Hazards in the Arts," Bertram Carnow, M.D., *American Lung Association Bulletin*, pp 2-7, Jan/Feb. 1976.

"Health Hazards in the Arts and Crafts," Michael McCann, Ph.D., presented at 105th Annual Meeting of American Public Health Assn., Washington, DC (1977).

"Health Hazards Manual for Artists," Michael McCann, Ph.D., Foundation for the Community of Artists, New York (1975). The cost of this is $3 plus 50 cents for postage.

"Textile Dyes Are Potential Hazards," Catherine L. Jenkins, Ph.D., Journal Environmental Health 40, 256 (1978).

Each bulletin is 25 cents and each article is 50 cents. Send orders to: Center for Occupational Hazards, Inc., 5 Beekman St., N.Y., NY 10038.

NORTH AMERICAN SOCIETY SNAG GOLDSMITHS

## GENERAL

### ARTISTS/CRAFTSMEN'S INFORMATION SERVICE
**806 - 15th St. N.W., Suite 427, Washington, DC 20005**

The Artists/Craftsmen's Information Service of Washington, DC, announced that it is in the process of developing a model consignment contract for use by artists, craftsmen, and art dealers throughout the country.

The need for a standard contract was stressed by Ms. Elena Canavier, Assistant for the Arts to Joan Mondale. "Much work has already been done at the local level by artist organizations and by lawyers — and even some state legislatures — on the problems of consignments and artist-dealer relationships. I think the next step is dissemination and coordination of these efforts: the various model contracts and state laws that have been proposed should be compiled and examined; the people who have worked on these issues should be in touch with each other. The time is ripe for us to reach a consensus of opinion on a basic consignment contract that can be used nationwide."

The Artists/Craftsmen's Information Service is actively soliciting the opinions, ideas, and suggestions of art professionals, on what should be included in consignment contracts. The Artists/Craftsmen's Information Service is inviting artists, craftsmen, gallery owners and art dealers to send in any copies of consignment contracts which they currently use; comments on the effectiveness of such contracts are particularly welcome, as are thoughts on what should be included in an ideal consignment contract. Persons interested in having their views heard on this subject are requested to contact the Artists/Craftsmen's Information Service, 805 - 15th St. NW, Suite 427, Washington, DC 20005 (telephone: 202/347-5585).

The Artists/Craftsmen's Information Service, a non-profit corporation founded in 1977 to encourage, promote, and advance American visual arts, craft, and folk arts, was organized to offer a range of educational and other charitable services to the public and the art community. Providing an ongoing source of information on topics like arts legislation, federal programs and activities, legal questions and similar matters relevant to artists and craftsmen, is one aspect of this service.

### HAYSTACK/GATEWAY AUCTION HELD IN NYC

A major auction of art in craft media by leading American craftsmakers was held April 26, at the Jack Lenor Larsen Showroom, New York City. Proceeds will be used to complete the campus designed by Edward Larrabee Barnes for the Haystack Mountain School of Crafts in Deer Isle, ME. Joan Mondale is Honorary Chairman of the event; Jack Lenor Larsen is Chairman.

Eighty art works were contributed by Haystack faculty members spanning the past 28 years.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## RECORD SALES INCREASES FOR STERLING FLATWARE

*(courtesy The Silver Institute Letter, Vol. IX, NO. 3, March 1979)*

Sterling silver flatware sales for 1978 increased by 28% over sales for 1977. This record increase in sales followed 1977's 22% improvement in sterling flatware over 1976 sales, according to the Silversmith's Guild. In addition to this major increase in dollar sales, there was also a healthy increase in sterling flatware unit sales, making it easy to understand why the industrial silversmiths called 1978 "fabulously successful."

Gerald Newmin, president of International Silver Company, Meriden, CT, reports that the continuing demand for sterling flatware reflects a renewed interest by consumers of all ages in traditional at home entertainment. Mr. Newmin said, "The simple fact is that sterling, as always, is a desired status symbol and is widely affordable through convenience starter Silver Club plans. As long as customers take pride in their environment and possessions, sterling silver will continue to be one of the most treasured funtional appointments in the home."

## CERTIFICATE/DIPLOMA COURSES IN JEWELLERY OR GOLD AND SILVERSMITHING

**by Felicity Abraham**

The following Australian colleges offer diploma or certificate courses in jewellery, gold and/or silversmithing at a craft/design level.

Training in these crafts is also available at some other institutions, but as part of another course, such as teacher training or as one of the subjects in an arts diploma. Some recognised jewellers provide training either through schools or traineeships. There are also trade courses in jewellery and gold and silversmithing, but these involve apprenticeship.

NEW SOUTH WALES: Randwick Technical College, Cnr. Darley Rd. & King St., Randwick 2031; jewelry design certificate course, two years full-time.

Sydney College of the Arts, 121 Walker St., North Sydney, 2060; diploma in jewellery and silversmithing, three years full-time.

SOUTH AUSTRALIA: Torrens College of Advanced Education, Holbrooks Rd., Underdale, 5032; associate diploma in jewellery and silversmithing, four year part-time course.

TASMANIA: Tasmanian College of Advanced Education, P.O. Box 1214, Launceston, 7250; associate diploma of arts in art & craft (2 years full-time, 4 years part-time); diploma of arts in art & craft (3 years full-time, 6 years part-time); graduate diploma of art in art & craft (1 years full-time, 2 years part-time); choice of workshops for above courses include gold and silversmithing as a major study.

VICTORIA: Royal Melbourne Institute of Technology, 124 LaTrobe St., Melbourne, 3000; diploma of arts (gold and silversmithing), three years full-time; graduate diploma in gold and silversmithing, one year full-time.

WESTERN AUSTRALIA: Western Australia Institute of Technology, Hayman Rd., South Bentley, 6102; associateship in design (three-dimensional design)*, this course covers mainly jewellery and silversmithing, three years full-time; associate diploma in art (can major in jewellery), four years part-time.
*W.A.I.T. have applied for this course to be given degree status in 1978. It will be Bachelor of Arts (Craft).

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## HEALTH HAZARDS

**(courtesy of Sculptor's News Exchange, Dec. 1978)**

Solvents are chemicals that dissolve things such as grease, oil, plastic resin, paint, lacquer, cellulose, pesticides, and office correction fluid. They also dissolve in your body, causing temporary or permanent damage. Solvents are the most widespread industrial chemicals, and the most widespread chemical hazards to workers. Almost everyone is exposed to at-least one solvent during the workday.

The safest solvent is water, but water is incapable of dissolving many industrial materials, so other chemicals are usually used. Most solvents are organic chemicals and all organic solvents are hazardous. All of them can harm your skin and make you feel drunk and dizzy. Some affect your blood. Others affect your liver, your kidneys, your heart, your eyes —almost every organ in your body. The symptoms of solvent poisoning are not always obvious. Some of the effects are subtle, like headaches and dizziness , while others, like liver and kidney problems can also be caused by other diseases and often are misdiagnosed.

Workers are exposed to solvents in two ways. First, solvent vapors can be breathed in, irritating the respiratory tract (nose, throat, lungs) and passing through the lungs into the bloodstream. Second, solvents can be splashed onto the skin. Sometimes this damages only the skin, but some solvents, like nitrobenzene, can pass through into the body.

Solvents have both acute and chronic effects on your body. Acute effects are caused by single or short-term exposures. Chronic effects result from long-term, day-after-day exposures, often to smaller amounts than are needed to produce acute effect. Perchloroethylene, in one high single dose, causes dizzyness, lack of coordination, and eventual unconsciousness. But a smaller exposure, over a longer period, damages the liver.

Two parts of your body most often affected by organic solvents are your skin and nervous system. Organic solvents dissolve the fats and oils in your skin, leading to dryness, cracking, reddening, and blisters. This condition is called dermatitis. Nerve cells are especially vulnerable to solvents in the bloodstream. All organic solvents affect the nervous system. Exposed workers feel drunk, dizzy, sleepy. Coordination and balance are affected. High concentrations can cause unconsciousness and death. These effects are mostly centered in the brain. They are called *anesthesia, intoxication, central nervous system depression,* or *narcosis.*

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Judith Brown

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# ORGANIZATIONAL NEWS

## PRESIDENT'S COLUMN

**June 1979**

Back from Boston and what was most certainly our biggest and, in many ways, our best conference yet. Over 350 people gathered at the Bradford Hotel for three days of varied programming, good food and fine fellowship. Huge thanks are owing to many, many members who spent the long hours necessary to insure the success of such a major undertaking. Special mention to George McLean and crew—Vince Ferrini, John Heller, Paul Keto, and John Wescott—for all their efforts, and to the students of Boston Museum School, Boston University Program in Artisanry, Massachusetts College of Art and the Rhode Island School of Design for welcoming us into their shops, generously showing us their work, letting us question, prowl and photograph. Also, our appreciation to the Boston Museum of Fine Arts, Reed and Barton, Towle, and The Jewelry Institute for their hospitality.

There will be reviews of the activities, both serious and frivolous, scheduled and impromptu, but I did want to make some general observations (although mine may not be the best vantage point). Informality and friendly exchanges seemed to reign for the three days. Several people had brought slides—of their work or of travels, collections, etc.—and they made use of the A-V equipment to show others. (We plan to have equipment available like this every year.) Many others, in a less formal way, were huddled in corners, holding sheets of slides up to the light. One can only imagine the number of "How do you do . . .," "Where do you buy. . .," or "How do they sell" questions going on all around. For once, the question of why is understood by all; this is what brings us together. In talking with Michael Croft, who is planning for next year (April in Tucson)—it was jokingly suggested that one whole day of the conference be left unincumbered with what would look educational on paper, just a big barbecue in the desert and plenty of time to talk. It is looking good for going to Atlanta in 1983, along with another major goldsmith exhibiton. Any suggestions for 1981 and 1982?

The Board, this time, just about "meetinged" ourselves to death — one day before the conference, one day during and several snatches of evening and late night hours; this in addition to the two business meetings. Yours truly is rebelling and we will have to schedule things differently in future!!! However, much was discussed which I should like to pass along.

Pro-members will have received this year's ballot for the elections and also for a long list of by-laws, plus the important question of whether the Society should become a non-profit corporation. One of the chief advantages of incorporation is that the Board, officers and members would no longer be personally financially responsible (liable) for the Society, but only the assets of the Society itself would be exposed. Should this vote be affirmative, a few other by-law changes would have to be made to be in accordance with the law. For instance, the Board of Directors would become a Board of Trustees. The attorney we have consulted can forsee no major difficulties in our making this change.

Next year's projected budget, approved at the general meeting, provides for two full-time employees for the Society. One will be an executive secretary in our main office to handle memberships, billing, tax preparation, and the enumerable inquiries which come in — now running 20-30 pieces of mail per day! The other person will be located with the Journal to oversee all the correspondence involved. This has been more than a one-person volunteer effort for some time, and Mark has hired several student helpers. It was thought that, for continuity and efficiency, one full-time person is now required.

A financial statement from the Society will appear yearly in the October issue of the Journal.

Journal advertisement is increasing and thanks are extended to all members who have and are continuing to mention to their suppliers that they appreciate their support of the Society in this way. Please use the addresses as given in the Journal ads; they are often coded by the advertisers so that they know which ads are getting results. We need their continued support!

It has been decided that our Journal, long since beyond being a simple newsletter, should have an editorial board. Mark Baldridge has borne the entire responsibility for four years and now it is time he was given some help! We will be looking for expertise outside as well as from within our Society for this — any suggestions or volunteers???

The A-V and Book Departments are running smoothly and the exhibit is on its tour in Europe. A catalog, produced by the Schmuckmuseum in both English and German is available through the Book Department for $5.50 to members, $6.50 for non-members. A set of 140 slides of this exhibition is available from the A-V Department: Pro-Members—$85; Associate and Student Members—$95; Non-Members and Institutions—$105. These prices hold until November 1, 1979, after which they go up. The set is not presently available for rental. Sandie feels it is time to update the SNAG movie and so will be needing material on recent activities.

The technical paper reprints, funded under the Tiffany Grant, are being worked on—slowly—but will now include all nine papers in one volume. Plans are to have a limited number of these available for purchase at a later date.

The Hallmark Stamp project is also progressing—slowly—but we expect some definite action this summer.

SNAG will have a booth at the NY Coliseum Show this year — generously donated by Bill Schroeder of Anchor Tool Co. Glenda Arentzen, Bernie Bernstein, Tina Boscarino, and Cathy Oblansny will be helping man it.

PROJECTS NEEDING VOLUNTEERS:

1. CAREER GUIDANCE INFORMATION—We want to write up something which can be sent out, upon request, to high school career guidance centers about the career of goldsmithing. Contact Marcia Lewis, Art Dept., Long Beach City College, 4901 E. Carson St., Long Beach, CA 90808.
2. GALLERY QUESTIONNAIRE—We are compiling a listing of shops and galleries which carry contemporary metalwork. I would appreciate it if you would send names and addresses of places you know of to me. We will be sending out a questionnaire to them to ascertain what type of work they carry, how they contact artists, etc., etc.
3. SURVEY OF METALS EDUCATION—To find out where metal is taught and what type of program they have. Contact Michael Croft, Art Dept., U. of Arizona, Tucson, AZ 85721; or Bob Mitchell, 1817 Colonial Rd., Jonesboro, AK 72401.
4. APPRENTICESHIPS—Many questions come in for which we have no answers: what are the existing governmental regulations surrounding taking on an apprentice; what are some of the problems encountered on both sides in this situation; who has taken on apprentices; who wants to; who is looking for such a position; how does it work in other countries. If interested in helping gather such information, please contact any of the Board or officers.
5. GOVERNMENTAL RELATIONS COMMITTEE—You may remember that a resolution was passed at the meeting in St. Louis stating SNAG should form a governmental relations committee. A call was made for volunteers — to date, no responses! If you would be interested in gathering information on national or local legislation and government policy which affects the goldsmith, please contact any of the Board or officers. It might be especially interesting to know how the situation differs between Canada and the U.S.

During our stay in Boston, meetings were held with representatives from several other organizations. Ted Nierenberg, new president of ACC, and Barbara Cohen of that organization, questioned various members to elicit their opinions as to how ACC could best serve the craftsman. That organization is undergoing great change and they are most concerned that the voice of the individual crafts-

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man be heard. I am sure any suggestions you might wish to pass on to them would be most welcome.

John McLean, assistant to the crafts coordinator of the National Endowment for the Arts, wished to publicize the new Building Arts Program — designed to support the research and planning of living environments which integrate the arts into buildings or grounds. They are also searching for people interested in the development or architectural components and architecturally related work. For instance, they have the Pennsylvania Avenue Development Corporation there in Washington, DC, interested in specially commissioned man-hole covers!!! Just think of the possibilities of starting to work with road and transportation authorities — the Art Nouveau subway entrances in Paris immediately come to my mind.

We also met with Susan Mellon of the Artist Craftsman Information Services, a non-profit organization in Washington, DC. They are currently working on developing a model consignment contract for use by artists, craftspeople and art dealers throughout the country. Should you have a contract which you use and would like to share with them, you could write to Susan at 806 - 15th St. NW, Suite 427, Washington, DC 20005.

We are also working on additional avenues of funding for the Society. Government grants are one way, but for specific projects and periods of time. We would hope that we could find ways to cooperate with private foundations or industry for mutual benefit. Suggestions most welcome.

There is always a high enthusiasm level as we leave our yearly gathering; this year it seems more than ever before. The Society exists so as to be a benefit to the field as a whole. It seems to be fulfilling the needs of the craftsmen as we have again doubled our membership since a year ago — about 1,500 members now!

May I add that the way to benefit most directly is to become involved. We, as craftsmen, should realize above all others that the result, the polished finished product only comes from the caring and concern to spend the time necessary. We all know the direct feelings of pride and satisfaction upon its completion. It is a marvelous thing that we can see ourselves, not as competitors, but as colleagues, working for the benefit of all — and having a lot of fun along the way.

Thanks guys — it sure was a good one!

Mary Lee Hu
Art Dept., Michigan State U.,
East Lansing, MI 48824

## NEW MEMBERS

**We welcome the following new members to SNAG:**

STUDENT MEMBERS:
Edward Curtis, Hazelwood, NC
Vasanthi Emmanuel, Rochester, NY
Gary Gissler, Milwaukee, WI
Marie Gniazdowski, N. Tonawanda, NY
Jeffrey Karliner, New Paltz, NY
Patrick V. Smith, Edinboro, PA
Lin Stanionis, Bloomington, IN
Ronda Throne, Philadelphia, PA
Evelyn Dickwisch, Mahopac, NY
Laurie Hoskins, Anaheim, CA
Jeannie Lukas, North East, PA
Barbara Mineo, So. Salem, NY
Elizabeth Gabbard, Tucson, AZ
Charles Gladstone, Dorset, VT
Joan Ann Kozlosky, Kent, OH
Debbie McWhinney, Oakland, CA
Dawn Nakanishi, Sunnyvale, VA
Eileen Quinn, Rochester, NY
Jane S. Reiss, Cornwall-on-Hudson, NY
Suzanne Rivest, Montreal, Quebec
Leonard Scarola, Laguna Niguel, CA
Robin Schechtel, N. Babylon, NY
Pam Slipyan, Kobenhavn, Danmark
Paul Willard, Phoenix, AZ
Nancy Worde, Athens, GA
Mary Anna Eklund, Sunnyvale, VA
Margherita Janson, Lincoln Park, NJ
Scott A. Barton, University City, MO
Gary Dixon, Royal Oaks, MI
Douglas Geivett, Ft. Collins, CO
Vernon Gross, St. Louis, MO
Michael W. Hillard, Rochester, NY
Lars Klove, Ann Arbor, MI
Constance A. Merrill, Brookline, MA
Jonathan Nedbor, Riverhead, NY
Gretchen Neumann, Onalaska, WI
Marilyn Blasczyk, Milwaukee, WI
Dan Fleckstein, New Paltz, NY
Lisa Gralnick, New Paltz, NY
Julie Hammet, Troy, NY
Dorothy Johansson, Denton, TX
Susan L. Maurer, Toledo, OH
Mary Pocock, Boston, MA
Paul D. Reilly, Oneonta, NY
John J. Satory, LaCrosse, WI
Paul Smits, Kingston, Ontario
Henk Wevers, Kingston, Ontario
Stephen A. Fedak, Las Cruces, NM
Marc Zimmerman, Brighton, MA
Katherine Davidson, Watertown, MA
Kimberlee Dent, Ann Arbor, MI
Carolyn Dorsey, Ann Arbor, MI
Donald Dransfield, New Paltz, NY
Jane Goldfarb, Ann Arbor, MI
Karen Heimann, Ann Arbor, MI
Randy Jones, Carbondale, IL
Ruth Taubman, Birmingham, MI
Gina Clark, Denton, TX
Joan Horn, Philadelphia, PA
Dana Standish, Cambridge, MA
Deirdre Donchian, Ogunquit, ME
Ruth Blumenau, Tucson, AZ

LIBRARY MEMBERS:
Alan B. Shepard H. School, Palos Hts, IL
Rochester Folk Art Guild, Middlesex, NY
Butler Library State University College, Buffalo, NY
Arkansas St. University Ellis Library, State University, AR
Library, Dept. of Education, Dublin, Ireland
Illinois State U., Normal, IL
Texas Woman's U., Denton, TX
Shoreditch College, Egham, Surrey, England
City of London Poly., London, England

PRO-MEMBERS:
Vickie Sedman, Elkins Park, PA
W. Kelley Morris, Whitewater, WI
Bruce Metcalf, Wayland, MA
Klaus Kallenberger, Murfreeboro, TN

ASSOCIATE MEMBERS:
Boomsliter & Zaruba, Buffalo, NY
Beverly Cameron, San Francisco, CA
John G. Carey, Georgetown, DE
Steve Foster, Toledo, OH
Harry Furches, Murray, KY
Lillian Kalan, Weston, MA
Randy J. Long, Des Moines, IA
Maude H. Lorah, Concord, MA
Neal Rosenblum, Worcester, MA
Shelleybrooke, Chester, NJ
C.B. Aksoy, Etobicoke, Ontario
D. Clayton, Capalaba Queensland, Australia
Marilyn Cooper, Wayne, PA
Marilyn Kalanzis, Hickory, NC
Kathy Kulesza, Milltown, NJ
Kwabena Sarpong, Kumasi, GHANA
James Skladany, San Bernardino' CA
R.C. Williams, Long Beach, CA
Emily Winston, Benicia, CA
Lynn R. Porter, Concord, MA
Nancy Barrett, Durham, NH

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## MEMBERS' NEWS

Samuel Beizer, N.Y., NY
Sarah Capps, Richmond, KY
Derek Hampton, Carlton No. Vic, Australia
Fred Pearce, Lyme, NH
Alan Perry, Manchester, NH
R.D. Peter, Thiensville, WI
Claudette Pilon, Verdun, Quebec
Sarah Schaffner, Harrisonburg, VA
Jan K. Stigberg, Cambridge, MA
Carol Cassidy, Halifax, Nova Scotia
Aaron Faber, N.Y., NY
Alfred Green, Denton, TX
John C. Scott, Jr., Lawrence, KS
Ruth C. Strick, Moorestown, NJ
Arthur Higgins, Wasilla, AK
Vincent Nicolett, Denver, CO
Mel Reisz, Ogunquit, ME
Jan K. Schonborn, Williamsburg, VA
Deborah Shankle, Isle of Palms, SC
Deborah Shapera, Chicago, IL
Shibui Enterprises, Stevenson, MD
Caroline Strieb, Philadelphia, PA
Vernon G. Wilson, Williamsburg, VA
Heide Wurlitzer, Ridgefield, CT
Peter Cullman, Willowdale, Ontario
Gherlaene Fauteux, Montreal PQ Canada
Paul W. Maresso, Brighton, MA
Mary Ellen McDermott, Akron, OH
Iris Schwartzbaum, Rochester, NY
Ellen Stock, Toronto, Ontario
David Frank, Portland, OR
Jean Powrie, Molalla, OR
Jane Erwin, Cambridge, MA
Stephen J. Flynn, Lempster, NH
David Goldfarb, Stamford, CT
Jean Hunderman, Kalamazoo, MI
Janet F. Maddox, Bethesda, MD
Komelia H. Okim, Rockville, MD
Bill Schroeter, Chatham, NJ
Gail Wolfskill, Cambridge, MA
Jan Yager, Kalamazoo, MI
Natalie Fields, Deerfield, IL
James C. Green, San Francisco, CA
K.J. McCullough, Tucson, AZ
Elma L.J. McKay, St. John, Canada
Warren G. LeFort, San Francisco, CA
Tina Boscarino, N.Y., NY
Trudy Borenstein, Levittown, PA
H. A. Molenaar, Le Tignit, France

E. Dickens Bishop had two pieces of work awarded prizes in the recent Texas/Designer Craftsman Show in San Antonio, TX, March 1-18: Wing Reliquary — Best in Show, Triangle Box — 2nd Place.

Cal State Long Beach, under the directorship of Dieter Muller-Stach is sporting a brand new graduate studio, plating room and much larger blacksmithing yard.

Viviane d'Adesky had an exhibit at The Elements Gallery, NYC.

Barton G. Daniels is having a major exhibit of his work (plastic and metal jewelry) at the Arnolfine Gallery, Bristol, England, for July & August.

Helen Drutt was guest curator of the "Olaf Skoogfors, 20th Century Goldsmith," and discussed "The Man and His Work."

Hannelore Gabriel received the top award in metals at the Las Olas Art Festival and a Merit Award at the Winter Park Sidewalk Art Festival."

Pat Garrett, Ellen Reiben, and Julie Shaw are in the Birmingham Bloomfield Art Assn — Birmingham, MI — The Enchanted Object: Toys and Games Show.

Stuart Golder had a piece in the Marietta College Crafts National for the 2nd year in a row. He has also been selected by the Ohio Arts Council for a short-term artist-in-residency at Walnut Hills H.S. in Cincinnati.

Richard Helzer is spending ten months in England and is on sabbatical leave from his teaching at Montana State U. While in England, he will be conducting a series of lectures at art schools in England and Scotland. The lecture tour will include visits to about 12 schools throughout the country. He is also completing a research project at the Ashmolean Museum in Oxford and the British Museum in London.

Klaus Kallenberger gave a "Model Making & Casting" workshop at ECU, Greenville, NC. He taught an intersession course in all forms of model making and casting at Middle Tennessee State University.

Betsy King, Peggy Johnson, and Julie Shaw are SNAG members who participated in Jewelry By Women Show at Forree-Johnson Metalsmiths in Chapel Hill, NC.

David LaPlantz, John Rotter, and Holly Sparkman participated in Humboldt Bay Area Metals Invitational at the College of the Redwoods Main Gallery in Eureka, CA.

On March 27, Long Beach City College and the Cal State Long Beach Art Dept. co-sponsored a workshop on "Machine Tool Technology" by Gary Griffin. Two hundred people from all over Southern California attended.

Jim Malenda had a one-man show at the Spring Street Enamel Gallery in NY from May 4-June.

Thomas Markusen received NY State University research fellowship (summer 1979) "Hot Smithing Process to Non-Ferrous Metals: Fabrication."

Tim McCreight has a new book out called "Metalworking Jewelry" from Van Nostrand Reinhold.

Hilda P. Melchoir is coordinating a CETA Art project, which is aimed at retraining the native people (of Point Lya and Wainwright) in traditional art skills like baleen etching, baleen boat making, ivory carving, whale vertebrae carving, including making masks.

Barry Merritt had a solo exhibit at the Gallery of Contemporary Metalsmithing in Rochester, NY.

The Michigan Silversmiths Guild had an invitational exhibition. Some of the SNAG members in the show included: Julie Shaw, Rosemary Elizabeth Gould, Bob Coogan, Tim Oakes, Joan Miller, Ken Stevens, and Frederick Hunter.

Julie Shaw and Pat Garrett participated in Northbrook Court Midwest Craft Festival. They were also in St. Louis Spring Craft Market sponsored by the ACE.

Mitsuko Kambe Soellner and Walter Soellner held a Jewelry, Enamel and Metalsmithing Exhibition at San Jose Museum of Art in San Jose, CA.

Kay Yee exhibited her work at the LA County Museum Rental Gallery. The metal work consists of wall pieces, small in scale, yet monumental in concept.

### CORRECTION

Our apologies go to Mary Ann Scherr whose name was omitted from the list of exhibitors in the "Silver in American Life" exhibition and article of JL 23.

# FEATURE ARTICLES

## A SURVEY OF NEW EQUIPMENT FOR JEWELLERY AND SILVERWARE PRODUCTION SHOWN AT TRADE FAIRS – 1974-1977 SPECIAL REPORT NO. 33 (PART I)

by Peter Gainsbury

*(courtesy of Worshipful Company of Goldsmiths Technical Advisory Committee, London, England)*

The fairs covered in this survey are Basel, Birmingham, Copenhagen, Milan, Munich, Paris, Providence, and Valencia, and some of the equipment discussed has in fact been seen at more than one of these venues, but unless otherwise stated, was principally shown at the manufacturer's home fair. The report includes data collected in the years 1974-1977, but naturally most emphasis is placed on equipment seen at the 1977 fairs and, in fact, the delay in reporting the earlier years has given an opportunity to see that some new ideas have stayed the course whilst others which appeared perhaps as prototypes have disappeared.

It is inevitable in a report of this nature that some items and their suppliers may have been omitted. Every effort has been made to ensure that every principal supplier to the industry who has been seen and supplied information has been mentioned, but if there are omissions, they are not intentional.

In order to give the most useful continuity to the information, it is arranged under subject headings rather than suppliers, fairs or countries. Prices, when given, are as far as possible 1977 prices F.O.B. city of origin at the time of the appropriate fair, and normally in local currency. No prices can be regarded as firm, the position regarding taxes and export discounts is variable and it has not always been possible to obtain up-to-date quotations.

### INVESTMENT CASTING

(a) Materials

In this area it is only feasible to write about hardware and not consumable materials. Variations and new names are appearing all the time in relation to rubber, wax and investment which require workshop trials before any sensible comments can be made.

(b) Vulcanising Presses

No major development in vulcanising presses has been seen during the past few years. The straightforward screw presses by such manufacturers as Hispana de Maquinaria and Sumes of Spain, Di Maio, Dal Trozzo and Boniardi of Italy, Lindner and Linn of Germany are well tried and modest in cost. More sophisticated hydraulic presses of KWS of Germany and Italimpianti of Italy offer more control of pressure, but at considerably higher prices. It should be noted, however, that accurate temperature control is the most critical factor in the successful production of rubber dies.

(c) Wax Injectors

Two interesting and very contrasting developments in wax injection have appeared during this period. Firstly, a step back to centrifugal injection by the American company, Swest Inc. of Dallas, who are offering a multiple-die centrifugal wax injector which will inject up to seven rubber dies in a single operation. The dies which are a truncated pear shape using less rubber than normal, are placed in a circular metal carrier with their sprue-opening facing into a central pouring hole. With the addition of a top clamping plate, dies are enclosed on all sides and it is claimed that multi-part or even badly cut dies are more readily handled than by conventional techniques.

The die assembly is spun in an enclosed chamber on a vertical axis and wax from a thermostatically controlled pot is ladled into the central pouring hole. While the dies are spinning and the wax cooling, a second set of moulds is prepared and, with the alternation of two carrier plates, high production should be obtained. The price of the machine in 1975 was $1,250.

High rates of wax pattern production can be obtained from conventional dies and standard air pressure injectors using the automatic injection device made by FIOA of Arezzo, but also offered by several of the Italian equipment suppliers. In this device the rubber die is pneumatically clamped and automatically presented to the injection nozzle for the required period of time. An early prototype of this machine was seen working at the Gori & Zucchi factory with one operator who placed and removed the dies from the machine and adjusted the air pressure as required while two girls on either side of him opened the dies, extracted the waxes, repowdered the cavities and closed the dies. As each girl was handling about six dies in sequence, very good team work was needed and large numbers of identical patterns to achieve smooth flow and the high production rates claimed, which were certainly much higher than could be obtained by five operators using five separate injectors. The 1977 price of the automatic device was 787,000 Lire, not including the injector.

For the production of very large patterns, injectors with extra high capacity of the order of five litres of wax have been offered by Di Maio and Italimpianti. An innovation shown by Hispana de Maquinaria in 1974 was an injector fitted with a stirrer for use with filled waxes, which at that time was priced at around 20,000 Pesetas.

(d) Investment Mixing

Several vacuum investment mixers have made brief appearances at trade fairs, some of which have not appeared to be very practical and appear to have been withdrawn. Well-tried machines described previously are two models supplied by KWS and that of Italimpiani now prices at $6,490. A business-like new machine was shown by Hispana de Maquinaria in 1976, but no information has yet been obtained on its performance.

Apart from the large fully integrated machines, Italian and Spanish manufacturers produce simpler power mixers with vacuum mixing facilities, but separate mould filling and subsequent de-aeration, sometimes combined with a vacuum casting machine. De Maio has been offering equipment of this type for many years, and more recent designs have been produced by Bega and Sumes in Spain, the prices of these being around 150,000 Pesetas.

(e) Dewaxing Equipment

The equipment suppliers have been slow to offer simple steam dewaxing equipment and most of the commercial equipment seen has been rather expensive.

The only atmospheric pressure steam dewaxer was that of Conley Casting Supply at Providence, who offer a front opening 3 ft. square steamer at $1,800. Three Spanish suppliers, Hispana de Maquinaria, Sumes and Bega offer steam dewaxers which operate at slightly above atmospheric pressure by virtue of weighted lids. These give raised steam temperatures of up to about 120 degrees C, with prices around 45,000 Pesetas.

Some suppliers, particularly the Italians, still favour dry dewaxing and low temperature ovens are offered by all the main Italian Suppliers.

(f) Burn-Out

Surprisingly, perhaps, no significant improvements in burn-out furnaces have appeared in recent years. The most advanced furnace seen was the rotary hearth furnace shown by Erscem at Munich in 1976 similar to the machines which have been on the market from Germany sources for several years. The price of the Erscem furnace in 1976 was F.Fr. 22,400.

Programme controllers which are now "de rigeur" for burn-out furnaces are not normally seen at trade fairs. An exception to this, however, was the very advanced solid state electronic controller suitable for either gas or electric furnaces introduced by Swest at the 1977 Providence Exposition. This device provides for three alternative burn-out cycles of six, eight, or twelve hours respectively, plus manual operation, and digital temperature read-out, all for $600. The impression was gained that some flexibility was lost compared with cam-type controllers, but no doubt further developments will overcome this minor handicap.

(g) Casting Machines

Much development has taken place in casting machine design in the past four years, a process that is still continuing, and much that is written now may soon be out of date.

Almost all developments seen have been in machines employing induction melting, but with the advent of the Munich Fair, opportunities have been presented to see the range of Lindner resistance-melting centrifugal casting machines which are perhaps not familiar to many readers.

There are four basic models of Lindner casting machines, with maxi-

mum melting capacities of from approximately 150 to 1400 g of silver. In these machines the carbon resistance heated furnace is mounted on trunnions on a power driven turntable. The mould to be cast is clamped, sprue-down, on top of the furnace, and when the metal is melted the turntable is spun and the furnace and mould tilted smoothly into the horizontal plane permitting casting to take place. The tilting is controlled by an adjustable oil dash pot so that smooth transfer of the metal occurs.

The use of carbon resistors ensures a reducing atmosphere over the melt so that the system is particularly suitable for silver and yellow and red golds.

Although ceramic inner crucibles are available for melting without contact with the carbon, reducing conditions prevail and there is a danger of pickup of impurities in those types of alloy, such as some white golds, which should be melted under oxidising conditions. Automatic temperature control is available via an indirect thermocouple, but as this is positioned outside the resistor there is a considerable differential between the true temperature reading and the actual melt temperature.

The Lindner machines were originally designed for dental use and many thousands have been sold. Protagonists of the machine are very enthusiastic for it, but others criticise low capacity, slow melting and short life of the carbon resistors which are said to need changing about every thirty melts. On theoretical grounds, the melting method is ideal for most jewellery alloys and the smooth casting process has obvious advantages. Possibly the ideal would be a design incorporating this semi-Durville casting technique, but with induction melting.

In 1975 the approximate prices of the basic machines ranged from DM 3,400 to DM 12,500 with about DM 2,000 addition for automatic temperature control.

The most revolutionary developments in induction melting casting machines have been static vacuum casting equipment led by the enterprising German firm, Inresa. Considerable refinement and development of the Inresa machine has taken place since first reported in 1973. The range has now been extended by the addition of a compact small-capacity machine melting up to about 200 g of silver and the availability of larger versions of the original machine, increasing the capacity up to 6,000 kg of silver.

The problems of vacuum melting have been mastered and the machines are supplied with a fully sealed melting chamber for use with vacuum or controlled atmosphere. More flexibility in control has been introduced, enabling the user to vary the automatic functions of the machine to his own requirements.

The principles of the operation of these machines were described in Special Report No. 23 and are not repeated here. The three larger machines are now sold as separate units with the motor-type high frequency generator and control cabinet as one unit and the melting and casting section as another, so that accessory units such as the continuous casting machine described later in this report can be added or the casting section omitted as desired.

The 1977 prices of the three larger motor generators were: 7.5 kVA - DM 33,000; 12 kVA - DM 36,000 and 20 kVA - DM 39,000. The price of the melting and casting section was from DM 10,000 upwards.

Another potentially important development in casting is the range of static vacuum casting machines under development by Obel Pedersen of Denmark, and shown in Copenhagen in 1974 and 1975. These machines are developed from the Balfour casting machine which was described in Special Report No. 28.

In 1975 Obel Pedersen showed two prototype machines, one of 1 kg nominal 18 carat gold capacity and the other of 10 kg 18 carat gold capacity. These were powered by 4 and 8 kVA valve-type high frequency generators respectively, the larger machine takes flasks up to 360 mm in height and 250 mm in diameter.

In these machines, melting and casting take place inside a large vacuum chamber and the melt is transferred to the investment mould by bottom pouring. In the larger machine, this was accomplished as in the Inresa design by plugging a hole in the bottom of the crucible with a closed-end graphite tube which is raised by a solenoid to allow casting. In the smaller machine, however, a rotating plug-type graphite valve was fitted under the crucible. A trouble-free, long life was claimed for this device, but at that time no experience was available to confirm this. Subsequently one user has reported that it works well with gold alloys, but that clean pouring is difficult to obtain with silver. The design was such that melting with these machines could be carried out in a full vacuum, the problem of glow discharge with radio frequency vacuum melting apparently having been solved. The most interesting feature following from this was that the operating system was arranged so that at the moment of pouring, atmospheric pressure was automatically admitted to the melting chamber while a vacuum was maintained on the base of the mould via a perforated support plate.

It is unfortunate that development of these very interesting machines appears to have become very slow since 1975, but it is understood that the manufacturer is still intending to put machines of this type on to the market.

The manufacturers of more conventional centrifugal casting machines with high frequency melting have introduced major and detailed improvements to their machines during the period under review, and other manufacturers have appeared. In 1974 Galloni introduced a centrifugal casting machine with induction melting in which a vacuum was applied to the base of the investment mould before and during casting and spinning.

There is no doubt that both centrifugal and vacuum-assisted are pretty efficient methods of jewellery casting used on their own. Whether one gets the best of both worlds and gains sufficient advantage to justify the extra cost of a combined machine is difficult to establish. Certainly, Galloni have produced extremely thin section castings to prove their point and attempts to reproduce these with conventional equipment have failed. As with vacuum wax injectors, however, one wonders how often in normal production there is a need for this super efficient mould filling ability. Certainly, claims are also made for other advantages but some of these are illusory. However, two vacuum-assisted machines, the Perfacast with 2 kg of 18 carat gold capacity and the Fusus Vac with 1 kg capacity are now established in the Galloni range. Both machines feature the well-tried immersion thermocouple temperature control which, despite some operating difficulties, remains in the observer's view the most reliable way of determining metal temperatures for casting. In their latest machines Galloni have incorporated digital read-out on their temperature controllers and this considerably facilitates reading. Prices of the two vacuum-assisted machines in 1976 were 2,700,000 Lire for the 1 kg machine and 3,700,000 Lire for the 2 kg model.

At the bottom end of their range, Galloni have produced a bench top machine known as the Fusus 72 for operation off ordinary mains supply which will melt and cast 150 g of 18 carat gold. The 1976 price of this machine was 1,650,000 Lire.

Galloni's principal Italian competitor, SAED, whose machines were shown in Milan by Dal Trozzo and Valencia by Benmayor, have also continued to improve their equipment, though perhaps sticking to a more conventional approach. Their machines range up to 5 kg of silver capacity and feature automatic press button tuning for different metals with settings for silver, yellow gold and white golds. These machines are fitted with optical pyrometers for temperature control. The 1976 price of the SAED 5 kg machine was 6,000,000 Lire. The 1975 prices of their 0.5 kg and 1.5 kg 18 carat gold capacity machines were 2,900,000 Lire and 3,480,000 Lire, without temperature control, both machines being fitted with a static side melter

of 2 kg or 5 kg capacity for alloy preparation, shotting or scrap melting.

A new Italian manufacturer of this type of machine is Boniardi who for the past few years has shown a 2 kg gold capacity machine in various configurations. The 1977 version incorporates vacuum assistance and an optical pyrometer and was priced at 6,000,000 Lire.

The French company, Erscem, continue to produce their range of induction melting centrifugal casting machines, and at Munich in 1976 they introduced a full vacuum centrifugal machine in which the whole casting arm and melting coil were enclosed in a vacuum chamber. Known as the "Centri-Vac 22" this machine has a capacity of up to 2 kg of 18 carat gold with a 5.5 kVA valve generator. The frequency used is comparatively low for this type of generator, 150 kHz, presumably to overcome the glow discharge problem. In layout the machine is similar to Erscem's well known "Ultracast 20", but is fitted with a pneumatically raised sealing lid.

It was very interesting to note that Erscem, who have always been staunch advocates of optical pyrometers on casting machines, have fitted their new vacuum machine with an immersion pyrometer as standard, with an additional optical pyrometer as an optional extra. The thermocouple, unlike that on the Galloni machines, remains in the crucible during casting, contact with the fixed wiring being broken by a simple mechanical system. This temperature control system is now offered as an alternative on the air melting Erscem machines. The 1976 price of the "Centri-Vac 22" was F.Fr. 60,000.

It is perhaps pertinent to emphasise at this point that most conventional 9 carat and 14 carat golds and some 18 carat whites cannot be melted under full vacuum due to loss of zinc by volatilisation.

All the air melting induction machines described in this report are now available with a means of providing a flow of inert or reducing gas into the melting crucible, but with the vacuum machines it is possible to obtain a completely oxygen-free atmosphere at atmospheric or reduced pressure by pumping out air before or during the early stages of melting and replacing the atmosphere with dry argon or nitrogen.

A word of warning should also be given about gas covers. Most of these machines normally employ graphite or clay-graphite crucibles for melting, and if moist gases come into contact with hot graphite, decomposition of the water content may occur, forming nascent hydrogen which will enter most molten metals, including silver and gold alloys containing copper, nickel or palladium, causing gas porosity on solidification. It is a wise move, particularly with argon, to pass the gas through a simple drier before use.

The number of manufacturers of centrifugal induction-melting casting machines continues to increase and there are now probably more manufacturers of this type of machine than plain torch melting ones.

A new name on the German jewellery scene is Linn Elektronik who have long manufactured dental equipment and have now introduced jewellery-scale production equipment at the Munich Fair, and in 1977 at the Basel Fair. The principal Linn casting machine is their "HFS6 Platin" model, the only machine on the market which is claimed to be especially designed for platinum casting, with a melting capacity of 600 g of platinum. Most of the machines described hitherto have difficulty in melting platinum, but the Linn machine has been demonstrated to be able to melt 500 g of platinum in three to four minutes. The machine is conventional in layout and control, and can of course be used for lower melting jewellery alloys than platinum. A separate version using a similar 6.0 kVA generator but with lower frequency and capacity of up to 2.5 kg of 18 carat gold is also available, together with small machines of 150 g and 1 kg capacities. The 1977 price of the platinum casting model was DM 19,800.

Another completely new machine has appeared in the United States, manufactured by Swest, Inc. which has the advantage for the American market of being entirely of American manufacture. This is a machine of conventional layout and for its rather large bulk has a modest power output of 5 kVA and capacity of up to 1.1 kg of 18 carat gold. The machine has simpler controls than its European competitors and an intriguing automatic read-out of its state of operation. The machine is offered with optional immersion or optical pyrometers and the 1977 basic price was $7,400 or $8,500 with pyrometer.

The centrifugal casting machines described above are all supplied — sometimes as an extra — with some form of speed or torque control. It is emphasised that the geometry of this method of casting is such that there is a strong possibility of turbulence porosity in castings made with excessive initial rotational speed and it is strongly recommended that power driven casting machines should always be used with a slow start to spinning, followed by speeding up when the metal has entered the mould.

No significant developments can be reported in non-electrical melting centrifugal casting machines during the past four years, but there have been some developments in vacuum-assisted static casting machines.

The pioneer of the large vacuum-assisted machines using perforated flasks was Di Maio, whose "Vacumental" was introduced in 1970. This machine has been copied and to some extent improved since then by other manufacturers but this year Di Maio have produced a new, more compact and stylish version with foot-operated vacuum release valve at a UK price of £1,252.

Machines of the "Vacumental" type of necessity depend on the use of relatively expensive flanged and perforated flasks. In the large sizes these are difficult to handle hot when they are loaded into the casting chamber. A method of employing similar principles of vacuum-assisted casting with large moulds, but enabling plain non-flanged flasks to be used, is the so-called vacuum press which appeared more or less simultaneously in Italy and Spain. The only major change in these machines since first seen in 1973 has been that the Spanish-made models by Sumes and Bega are now offered with accessory melting hearths for gas torch melting on the machine.

In the years since these machines appeared, not one has been encountered during factory visits. In 1975, however, Boniardi organised a practical demonstration in Milan, when, despite complete unfamiliarity with the machine by the operator, it worked very well with plain unperforated flasks. The prices of basic machines of this type in 1977 were: Boniardi—1,500,000 Lire; Sumes—159,900 Pesetas and Bega—200,000 Pesetas.

In these machines the mould is positioned completely inside a vacuum chamber and raised by either pneumatic or screw pressure to seal against a heavy lid which has a central pouring hole. The casting principle is the same as with the "Vacumetal" type of machine. There is a separate large vacuum chamber which is pumped down in advance and at the moment of pouring, a valve is opened, applying the vacuum to the casting chamber which is sealed from the atmosphere by the mould. The metal is forced into the mould by atmospheric pressure and not "sucked in by vacuum." Higher than atmospheric pressure could only be obtained if the melting chamber were to be pressurised as in some small dental casting machines.

There is considerable evidence that at least under static conditions one atmosphere or even less is adequate for all normal types of jewellers' and silversmiths' castings. By calculation, it appears that casting pressures in centrifugal machines may be much higher, and research is urgently needed to establish the true facts of casting pressure requirements to remove the guesswork and empiricism in machine design.

## SOFT METAL CASTING

The major development in this area has been the appearance of multiple die automatic casting machines with self-contained melting furnaces.

The most advanced machine of this type was the "Vac-U-Cast" shown by Frank Pertot in Providence. This is a fully automatic machine, the operator merely placing the empty moulds on a six-station indexing turntable and stripping out the finished castings. The metal is held molten in the machine and the moulds evacuated and filled by atmospheric pressure while being automatically spun. The melting furnace is gas-fired and air pressure is required for pneumatic features of the operation; the vacuum pump is built in. Nine or twelve inch (220 or 300 mm) moulds can be accommodated and a sustained production rate is claimed of two hundred moulds per hour with a single operator. The price of this machine is $18,000, and a gravity pouring model of similar configuration and capacity is also available at a lower cost.

The Italian firm of C. & A. Besena also produce a machine of this type with gravity pouring. In both this and the Pertot machine, the metal is drawn from the bottom of the melting pot, eliminating dross inclusions. The Besana machine is rather larger than the Pertot machine, with eight casting stations and accommodating moulds up to 500 mm (20 in) in diameter. The 1977 price of this machine was 9,400,000 Lire.

Two completely new automatic machines of a different configuration were shown by Boniardi in 1977. In these the rubber moulds are placed on a sliding table and loaded and stripped from alternate sides of the machine. Two sizes were shown; for 500 mm moulds the price was 8,000,000 Lire and for 300 mm moulds, 5,400,000 Lire.

No other new developments in soft metal casting have been observed recently. Wide ranges of conventional equipment have been seen at Providence, Milan and Valencia, with the Italian equipment appearing to have a great deal more thought put into its design than the American which, though undoubtedly efficient, is decidedly crude in appearance.

Recent years have seen considerable increase in the range of general metal processing equipment seen at the trade fairs.

## METAL PROCESSING

A. MELTING and ALLOY PREPARATION—At Milan, Dal Trozzo (SAED), Galloni, Italimpianti and Di Maio have all shown induction melting furnaces with capacities up to 200 kg of silver in one case, but more generally around 12 to 15 kg of silver. The bigger furnaces by Galloni and Italimpianti have featured power pouring and the small models by all manufacturers have either tilting devices or lifting gear for easy handling of the crucibles.

In 1977 Italimpianti introduced a complete ingot mould system to be tailored to the customer's requirements. For example, a system providing two plate and six wire ingot moulds was priced at 2,500,000 Lire and an accompanying 20 kVA furnace with power tilting and 12 kg silver capacity was 13,300,000 Lire.

Using carbon resistance melting furnaces as described for their centrifugal casting machines, Lindner supply a range of tilting static melting furnaces with semi-Durville ingot casting, with melting capacities of from 300 g to 3 kg of silver in four models with prices ranging from DM 2,098 to DM 7,246 (in 1974).

In contrast, in 1977 at Munich, Seltsam showed two small hand pouring electric resistance furnaces—an American Jelenko model with a capacity of 1 kg of silver at DM 1,400 and a German-made model, which though having a capacity of only 150 g, was priced at DM 1,300.

Turning to gas melting, Sumes at Valencia offered very neat gas-fired melting furnaces with built-in electric blowers at around 14,250 Pesetas for an 800 g silver capacity model to 67,920 Pesetas for 35 kg silver capacity.

Perhaps the most significant, and to the jewellery industry, completely new development in alloy processing is the continuous casting machine for bar and rod developed by Inresa for coupling to the generator of their casting machine discussed earlier.

Continuous casting has been used for some time in large scale production, even of gold and silver alloys, but the equipment available has been so large and expensive that the application of the process has only been viable for bullion dealers or the very largest of fully integrated manufacturers.

The Inresa machine still has a production rate such that the weekly metal requirement for a quite large sized firm could be produced in a few hours, but the cost at DM 20,000 is quite modest if an Inresa casting machine is already in use or purchased at the same time.

A separate complete continuous casting machine with induction generator and control unit costs from DM 70,000 for a production rate of 10 kg of silver per hour, and equipment is available for production of up to 250 kg of silver per hour. The sizes of products claimed are rod 5 to 15 mm diameter, bar 25x8 mm to 100x8 mm, and tube 25 to 45 mm diameter x 4.5 mm wall thickness.

The products are produced horizontally from a graphite die, employing an electronically controlled push-pull device for the draw-off. It has not been possible to see this machine in operation, but samples of its production have shown an impressively high quality.

(B) ROLLINGS MILLS—A bewildering variety of rolling mills is now available for the jeweller or silversmith. At the Milan Fair, major displays of mills from simple hand rolls up to large breaking-down mills with rolls up to 400 mm (16 in.) wide can be seen on the stands of Di Maio, Dal Trozzo, Cavallin and Boniardi.

Di Maio and Dal Trozzo in particular produce very sophisticated large mills. For example, the largest Dal Trozzo mill features powered screw-down with micrometric pinch control, full oil bath gears and pressure bearing lubrication, Cardan drive-shaft joints, and in common with all Dal Trozzo power mills, an emergency brake. The price of this mill is 30,000,000 Lire.

Down at the other end of the power mill scale, Cavallin offer a double 175 mm mill, the flat rolling side of which is fitted with a special patented device which holds the plate flat during rolling and gives complete protection against the possibility of trapping fingers between the rolls.

In Spain, a full range of jewellers' rolling mills is produced by the firm of Tatum and shown at Valencia by Sumes and also at Providence by an American importer.

Specialist mills have also been seen in profusion from large flatware cross-rolling mills by Di Maio, described in a previous report, to small pattern rolling and wire flattening mills by most of the Italian suppliers. An unusual machine seen at Milan in 1977 was a prototype "Turks Head" mill shown by Cavallin at a price of 11,400,000 Lire.

(C) WIRE PRODUCTION EQUIPMENT—Multiple and single die power wire drawing machines are offered by all the main Italian suppliers. A typical example seen in 1976 was a twelve die machine by Boniardi, priced at 11,500,000 Lire. Ancillary equipment, such as flattening and patterning rolls and coiling machines, is available, and Di Maio and Boniardi both offer small bench-top swaging machines for wire patterning at prices of around 1,750,000 Lire.

(D) STRIP FORMING EQUIPMENT—At Milan in 1977, Di Maio introduced a new range of forming machines for narrow strip. These were small bench top machines, the simplest of which could convert flat strip to a "U" or channel section, or even square tube at a cost of 2,400,000 Lire and a second machine which could convert flat strip to oval or round "U" section frames at a cost of 6,400,000 Lire.

A much more sophisticated machine which has been described before, but continues to impress, is the automatic tube-making machine of Dal Trozzo. This machine rolls

strip into tube of various sections and subsequently argon-arc welds the seam. The basic price is now 10,000,000 Lire, with tooling costs additional and dependent on the size and section of tubes required.

## CHAIN MAKING EQUIPMENT

With the current fashion for chain jewellery, there has been great interest in chain making equipment and a proliferation in exhibits of machines and associated equipment at the trade fairs.

Apart from the old established machinery manufacturers Fischer Fico of Germany and OMBI and FASTI of Italy, several other manufacturers have appeared in recent years to confuse the potential buyer. Emigezzeta, a subsidiary of Gori & Zucchi, is now making machines originally developed by Gori & Zucchi for their own use. Koch of Pforzheim, long an agent for other people's machines, is now producing his own range and Tatum of Spain are appearing on the international market.

All the foregoing manufacturers make wide ranges of chain machines and are only able to show a selection from these at any given fair. Chain machines are more or less standardised and manufacturers compete on speed of operation, ease of tooling, noise levels and styling, apart from the obvious factors of price, reliability, service facilities and delivery. The machines of Emigezzeta and Fischer Fico appear more modern in styling than their competitors and these companies have made positive efforts to reduce noise levels by enclosing some of their machines. The machines of Koch appear to be more solidly constructed than those of the older manufacturers and this company claims to have specially designed tooling for easy inter-change in situations remote from the manufacturer's factory. These factors are almost certainly reflected in the relative prices of the machines.

Illustrative of modern developments seen in 1977 was the new Figaro chain machine of Emigezzeta, which could be automatically set to produce mixed link chains from two different wires with a wide variety of link combinations, complete with automatic digital indication of setting and production rate. The price of this fascinating device was $14,600.

Developments in equipment for subsequent processing of chain are more readily described than those of the actual chain making machines. A bottle-neck in chain making production and a frequent source of problems is the powder soldering process used with non-cored wire. An outline of the process is that the chain is first coated with castor oil, then with a zinc and phosphorous powder mixture which penetrates the open joints in the links. The excess oil and powder are then cleaned off and the chain coated with talc to prevent sticking during soldering; these processes are largely carried out by hand.

Special barrelling equipment has been produced by Di Maio and Italimpianti to help to eliminate some of the hand work in chain coating, but in 1976 at Milan, Di Maio showed a prototype machine which automatically processed chain from the castor oil dipped stage to ready for soldering. In 1977 the definitive version was shown with facilities for coating four strands at once in continuous lengths. It was claimed by Di Maio that this machine priced at 12,000,000 Lire was a must for any manufacturer with more than ten chain making machines in continuous operation.

The principle of the machine is that, using tubular guides, the chain passes through a series of shallow trays containing the appropriate powders, with cleaning by passing through silver sand. The chain is shaken at carefully controlled rates as it passes through the various trays to achieve the required effects of coating, removing surplus powder and cleaning.

After coating, the chain is then soldered by passing through a flame or induction coil, or through a controlled atmosphere resistance furnace. The heating causes a reaction between the zinc, the phosphorous and the gold or silver alloy, forming strong joints. Gas soldering can only be done on a single strand of chain, and careful supervision is required to ensure sound joints without the chain losing its flexibility.

Gas heated chain soldering devices are usually produced by the machine manufacturers, but specialised electric soldering furnaces have been produced by others. The first widely used chain soldering furnace was that of Italimpianti described in earlier reports.

In 1977 Boniardi introduced a new single strand soldering furnace in which the chain passes down a vertical tube in a controlled atmosphere. A special drive ensures that no stress is placed on the chain to cause distortion when in the hot state. This furnace was priced at 2,250,000 Lire and was also usable for continuous bright annealing of wire.

With the fashion for bright cutting of chain, most manufacturers of diamond faceting machines have designed special units for the continuous machining of chain surfaces. These have gradually become more automated over the past few years and the ultimate in current development is probably the four-head machine of FOV which can diamond machine all four sides of a square section chain at a single pass—though at a price of 16,800,000 Lire.

A very different approach to the machining of chain was first seen in the Arezzo factory of Gori & Zucchi, where it had been used for some time, though shown as a commercial process for the first time in two different versions by Dal Trozzo and FIOA at Milan in 1977. This, in fact, was an extension of an idea proposed on a small scale by the writer some ten years ago.

In this system, a length of chain is wrapped around and secured at its ends to a hollow drum about 300 mm in diameter by 1 m in length mounted on a standard lathe. The drum is connected via a rotating seal to a separate refrigeration unit behind the lathe. Initially, water is played on the slowly turning drum with the refrigerant being pumped through it. This rapidly forms a layer of ice over the drum and chain, rigidly holding them in position. The chain and its coating are then machined as required with diamond tools and when machining is completed, the refrigeration unit is reversed, rapidly melting the ice and freeing the chain.

The advantages of this type of unit are that no special tooling is required to cope with any size or pattern of chain, and costs are much lower than purpose-built faceting machines. For example, the drum mandrel of the Dal Trozzo equipment was priced at 500,000 Lire and the automatic refrigeration unit was 3,448,000 Lire. Lathe costs need not be great as it would in any case be undesirable to carry out this operation on an expensive lathe, and FIOA had their unit mounted on a low cost British Boxford lathe of the type used by amateur engineers.

Electroplating of chain is another area which has exercised the ingenuity of equipment designers. Obtaining an even current density over a length or hank of chain in a plating bath is a problem, due to the multiple contacts and potential resistance points between each link. Variations in current density lead to variations in plating thickness, quality of surface and colour. A solution to this problem devised by some manufacturers has been to suspend the hank of chain over a rotating horizontal cathode which keeps the chain moving so that high resistance points are not maintained and the variations in current density with differences in distance from the cathode are averaged out over the plating period. Plating outfits featuring this facility were shown at Munich by Heraeus and Fischer Fico and at Valencia by Sumes.

Once long lengths of chain are produced by the continuous process described above, it is necessary to cut the chain accurately to the required short lengths for final use. Two very different machines have been seen for the automation of this operation. Firstly, the American Crafford automatic chain cutter, which is a bench machine using electronic circuits and micrometer adjustments automatically cuts lengths from 3/16 in to infinity. The latest version of this machine incorporates

LED digital setting and batch counting displays, variable speed and safety devices and holds the chain stationary while actually being cut. The machine requires both compressed air and electric power and was priced at $4,420, a price which has remained unchanged since the 1975 Providence Exposition.

A completely new machine introduced by FOV incorporates purely mechanical action with length cut being set by the relative positions of six cutters set on a vertical face plate and moved radially by a scroll mechanism to adjust the length of chain cut. The machine appeared to be capable of high speed operation, but seemed extraordinarily large and heavy for such a delicate operation, and rather limited to the range of lengths it could cut. The price was 8,900,000 Lire.

DIAMOND MACHINING

With changes in fashion and possible saturation of the market, diamond faceting machines had less showing in the past three years than previously. The leading Swiss manufacturers appear to be concentrating more on watch-case making and finishing machinery than jewellery decorating techniques, and improvements appear to be more of a detailed nature than revolutionary.

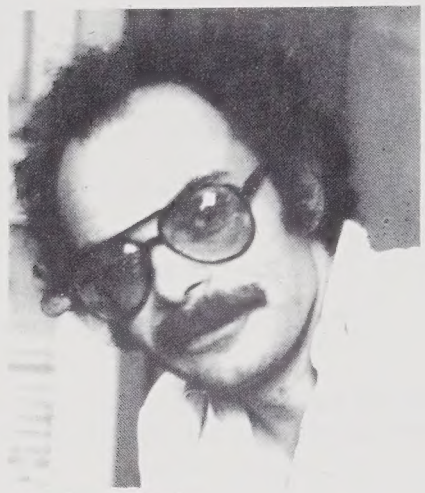
An interesting development of diamond faceting first noted in Spain does not use an expensive faceting machine at all, but merely a small single counterbalanced cutter costing $54 from Hispana de Maquinaria. The cutter is used in a normal jeweller's handpiece, preferably with high speed drive and is used to make narrow bright cuts on irregularly contoured areas such as in ring heads.

Diamond lathes particularly for wedding ring production are shown at most fairs, even including Basel, which is the one place where Benzinger lathes are seen rather than at Munich. Equipment of this type is also shown at Milan by Di Maio and FOV, and at Valencia by Hispana de Maquinaria and Sumes.

(Continued next issue)

## CONVERSATIONS WITH STANLEY LECHTZIN PART III

by Mark Baldridge



*Stanley Lechtzin*

MARK: You mentioned you are planing an industry conference — could you elaborate a bit more on that?

STANLEY: Well, things are premature at this point, but I am making overtures to members of the industry to come to Tyler and participate in discussions with the faculty and students. Hopefully, we can find ways of working together by establishing an industry internship which could be utilized at the appropriate time by our students. This would help them understand the demands of the jewelry companies and how they could best put their talents to work in this field. It would also acquaint industry with what the students are capable of and, ideally, a mutually supportive relationship would develop.

MARK: Do you feel the jewelry industry is now ignoring the university output of metal graduates?

STANLEY: Definitely — they are turning to the establishment of their own school and training program to provide the skilled workers needed. And this is far more costly to them in many respects. Whereas we have established reputable jewelry programs all over the country, industry has to "import" students to a central location such as New York or Providence, Rhode Island.

MARK: Do you feel our metal students are currently capable of working in industry?

STANLEY: At this point, probably not, because we have virtually no contact with them and, therefore, know little about who they are and what they want or need. In addition, they don't know what we can do, so the whole concept has to be approached with an open mind by both sides. There is a general and pervasive attitude among artists that business people are crass materialists who think strictly in terms of profit and loss. Then the business people tend to view artists as starry-eyed dreamers living in an ivory tower — oblivious to the hard core reality of the market place. In actuality, these are both extremes. We have very practical artists and farsighted business people — our problem is getting the two together.

MARK: You mentioned an internship type program earlier which would obviously help close the gap between schools and industry. Do you envision a sort of apprenticeship?

STANLEY: No, not necessarily. That is one possibility; however, I think apprenticeships direct themselves toward developing benchworker skills and most of our graduates with university degrees want more out of life than 30 years at the bench working for somebody else. I would like to see a system develop whereby our students might initially start out working at the bench, say for a year or two, and then move on into a managerial or decision-making capacity.

MARK: Do you feel we will reach the level of communication in the near future with industry that will make this all possible?

STANLEY: Well . . . it won't occur overnight. There has to be a courtship on both sides and a basic trust built up that neither wants to exploit or rip off the other. This concept is something I recall discussing very early in the formative stages of SNAG with my colleagues and I feel it's still something most SNAG members would subscribe to. However, nobody has taken the initiative with any type of long-term planning. I'm not saying I'm going to be the one to provide this either, but I do believe it is an area of responsibility that should be addressed.

MARK: Previously, M.F.A. graduates generally planned on a teaching career, but now with our dried-up job market, many are looking for alternatives. Do you feel industry possibilities will be attractive to these individuals or should we try and discourage students from a future in metal?

STANLEY: Oh, I don't think we should be discouraging. I see many starting out on their own now and earning a rather good living. It all depends on their motivation — you have to be willing to work hard to develop a business and establish a clientele. But that's true for any business venture. Also, I'm perceiving a new level of awareness on the part of a few companies— they are looking for fresh points of view and trying to visualize 20 years down the road — Reed & Barton, for instance, with their designer series. I think we'll see more of this in the future as the creative arts continue their period of growth and demand.

When I came out of graduate school, the commercialization of crafts was just beginning. Now, we have newsletters, journals and other publications directed toward the working, practicing craftsman. There is a market out there and people are interested. I would like to suggest to those of you earning your living from your craft to take advantage of this. We should be taking a larger share of the market than we currently are. It seems most people involved in the craft fair round are individuals who have appeared through the avocational route. They may have had a hobbyist-type course, workshop or two, or they may have just picked it up on their own. Friends and neighbors liked what they were doing and they naturally expanded into the rounds of the art fairs. Then they discovered, "hey, this is paying better than the old 9-5 job," and suddenly they are practicing craftsmen.

MARK: Graduates probably haven't explored this level of marketing because the majority of college metalsmithing and jewelry professors know little of it and, thus, have not encouraged this route.

STANLEY: Right! We teachers don't have that in our experience by and large, so we can't fall back upon personal knowledge to demonstrate how to achieve this. Most of us have a limited background in even selling our work and, therefore, don't really understand solid business practices. Probably, before we go too much further, we as educators must re-educate ourselves so we can help our students. Alternatives exist — we must be willing to find them.

## CLASS ASSIGNMENT: DESIGN WITH DIAMONDS!

by Betsey Irwin

Students of the Gold and Silversmithing course at New Paltz State University were given an assignment last year to design jewelry with diamonds the university had received in 1978 as a result of their participation in the national Diamonds Tomorrow competition.

The Diamonds Tomorrow competition, sponsored by the Diamond Information Center on behalf of De Beers Consolidated Mines, Ltd., (the world's largest marketer of rough diamonds) was initiated in 1975 by the Diamond Information Center to stimulate jewelry design students to use diamonds as a medium to express their art.

The principal objectives of the competition are to encourage fresh, new approaches in diamond jewelry design; to draw talented young designers into the jewelry design field; and to inspire students in jewelry design courses to work with diamonds.

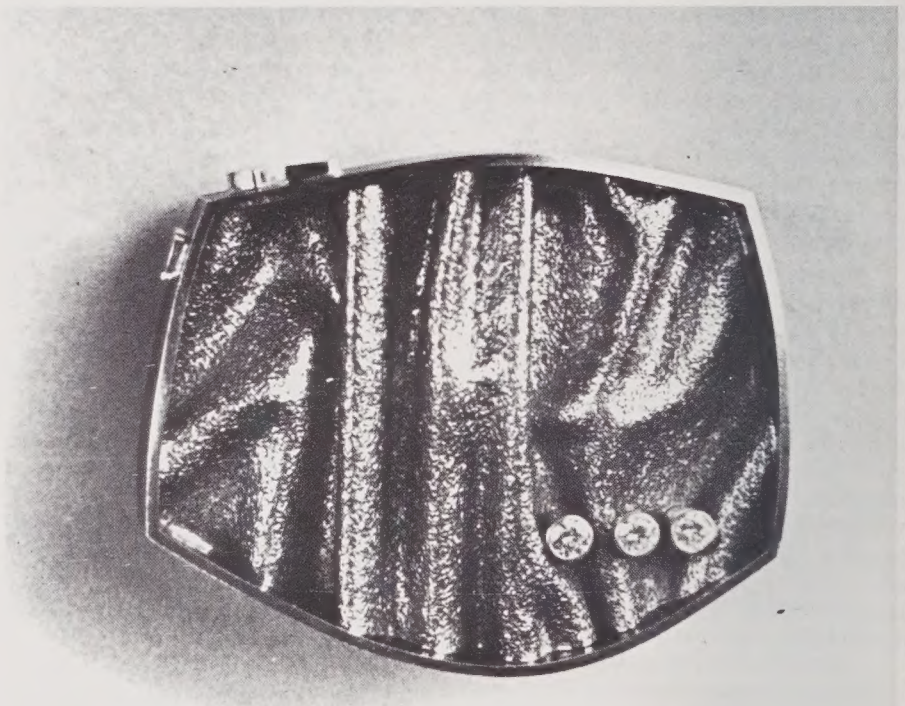
Lazare Kaplan & Sons, Inc., leading diamond cutters, generously donated "Diamond Purses" with diamonds of varied size valued at $1,000 each, to enable students of jewelry design to work with diamonds in their classes. The "Purses" were to be awarded to five schools, colleges or universities entering the competition. The schools selected were based on the number of students entering, winners from each school, and if the school had facilities for making jewelry, thus being able to use the diamonds.

Upon receipt of the "Purse" at New Paltz, professors Kurt J. Matzdorf and Robert W. Ebendorf started planning how they could use the diamonds to the best advantage of their students and the school. They decided on a class assignment where the students were to design diamond jewelry pieces utilizing the diamond purse. The sketches would be judged by a special panel and the winners would make their designs up into finished jewelry. The students themselves would execute the pieces in the metal they were accustomed to working with, and a professional would set the diamonds into the pieces.

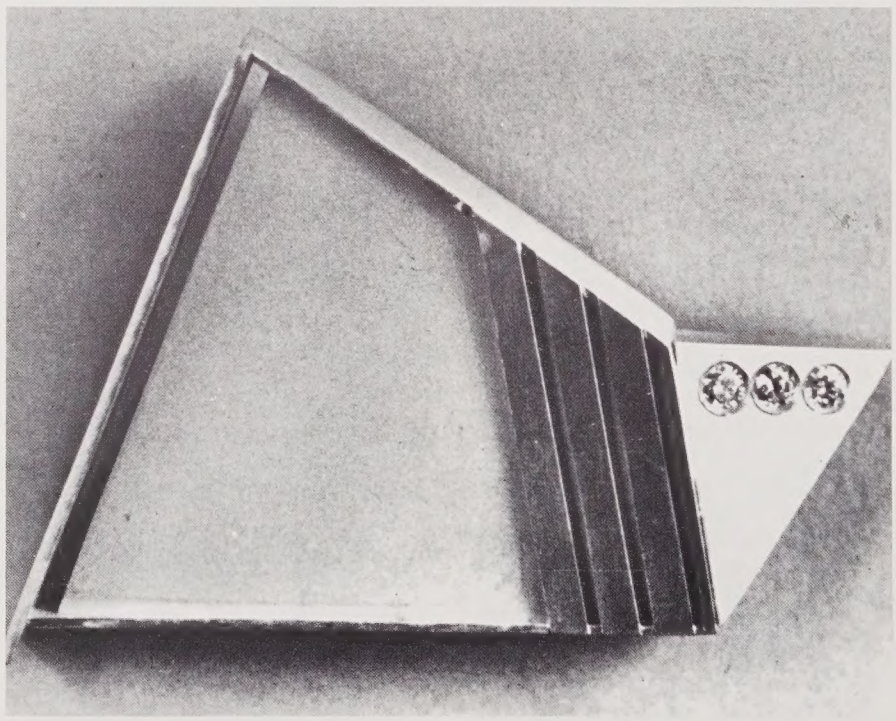
The judging took place in January of this year. Professors Matzdorf and Ebendorf and designers Glenda Arentzen and Ivy Ross comprised the panel of judges. They selected eleven designs to be made into finished jewelry.

In commenting on the judging, Miss Arentzen said, "We jurors were surrounded by 'what if?' with diamonds. Only those designers unencumbered by commercial considerations can ask, 'what if?'. By suggesting the use of diamonds with as yet unpopularized materials and techniques, these students have given tangible form to wonderings. It is the true basic research of the jewelry trade which may not reach the market for years. I look forward to seeing the results, since works crafted by the designer him/herself have a very special lively excitement."

Professors Matzdorf and Ebendorf said, "The generous gift of a 'Diamond Purse' by Lazare Kaplan & Sons has proved especially valuable to us who in our broad-spectrum gold and silversmithing program are engaged in educating designers for the goldsmithing industry by providing the precious raw material that would ordinarily have not been available to our students. We believe that the works of art, small in scale but not in concept, that our students created with the splendid support from members of the industry are clear evidence of what can be achieved when the intellectual and artistic resources of the State University of New York and the material resources of the jewelry industry join forces. We in the gold and silversmithing program at New Paltz look forward to a continuing and expanding period of cooperation with the industry for the benefit of all involved."



*Cathleen Bunt, belt buckle, sterling and diamonds*



*Jane Reiss, brooch, gold-plated sterling with diamonds*

The eleven designs selected are the work of six students: a brooch and belt buckle by Cathleen Bunt; a hair ornament and men's collar pins by Heidi Heifetz; a brooch by Donald Dransfield; two brooches by Jane Reiss; a brooch and a brooch/belt buckle by John Cogswell; and earrings and a single ear ornament by Sandra Roseman.

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